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CONTENTS

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NOTES ON PARASITIC FUNGI IN WISCONSIN. XX.

J. J. DAVIS

PERONOSPORA FLOERKEAE Kell. was collected by Holway in northwestern Wisconsin in 1904. When taking a collection of Entyloma on Floerkea from the press it was found that two small plants bore the Peronospora. The collection was made near Racine in southeastern Wisconsin May 15, 1933.

Petrak has proposed the genus Metacoleroa to receive VENTURIA DICKIEI (B.&C.) Sacc. (*Ann. Mycol.* 25: 332).

As there was some question as to whether the Taphrina that has been collected in Wisconsin on *Onoclea Struthiopteris* is T. STRUTHIOPTERIDIS Nishida or T. HIRATSUKAE Nishida a Wisconsin specimen was sent to Prof. Hiratsuka, who determined it as the former.

MYRIOCONIUM COMITATUM var. SALICTARIUM "Notes" IV, p. 286 is probably connected with SCLEROTINIA FOLLICOLA Davidson & Cash (*Mycologia* 25: 266-7 & 270).

In "Notes" XIII, pp. 171-2 GLOEOSPORIUM NIVEUM was described as occurring in ascomata of Rhytisma on *Ilex verticillata* and on species of Salix. There was discrepancy in the size and shape of the conidia on Ilex and in those on Salix and while both forms were described and figured under the binomial their specific relationship was left open. Dr. John Dearness has kindly sent material on *Ilex verticillata* collected near London, Ontario in which the conidia are like those on Salix but more acute. Similar collections on Ilex have also been made in Wisconsin and it seems clear that but one species is involved the conidia of which are somewhat variable in size and form.

MARSSONINA THOMASIANA (Sacc.) Magn. sometimes develops acervuli on the twigs. Young conidia are pyriform but the lower cell broadens with maturity.

In "Notes" XVII, p. 296 Colletotrichum on leaf spots on Streptopus, Oakesia, Smilacina and Uvularia was treated as parasitic and referred to C. PECKII Sacc. It now seems more probable that the spots were not caused by the Colletotrichum

but that it followed as a saprophyte. In May, 1933 Colletotrichum was found at Racine on leaves of *Trillium recurvatum.* The host plants were in a low place and had apparently been submerged after the heavy spring rains. They looked sickly and there were dead areas on the margins of the leaves sometimes extending toward the center. On the dead tissue Colletotrichum occurred. A specimen was sent to Dr. L. R. Tehon who reported that the fungus was like COLLETOTRICHUM TRILLII Tehon but that the spots were different. In June, 1933 Colletotrichum was found on dead and dying leaves of *Allium canadense* in the same region. A Colletotrichum on dead spots on leaves of *Smilax hispida* was found at Coon Valley in August, 1932. Perhaps these are all saprophytic and should be referred to COLLETOTRICHUM LILIACEORUM (Schw.) (*Vermicularia liliaceorum* Schw.). COLLETOTRICHUM CIRCINANS (Berk.) Vogl. on bulb scales of *Allium Cepa* perhaps belongs in the same group. However, in 1934 collections of Colletotrichum on leaves of *Clintonia borealis* were made at Hayward and Mellen, in which the fungus appears to be parasitic. The black acervuli are scattered on pale brown to cinereous spots which are sub-circular to oblong, 1-4 × 1-2 cm. sometimes confluent. Death of surrounding leaf tissue, especially distally, soon occurs. The setae are black, terete, up to 140 × 6-10μ. Conidia hyaline, fusoid, slightly curved, acute, about 20 × 3μ. It is probable that on full maturity of the fungus the entire leaf is dead. (See Burt Johnson, *Am. Journ. Bot.* 19: 12 et seq.)

In Wisconsin a leaf spotting fungus on Smilax has been referred to STAGONOSPORA SMILACIS (E.&M.) Sacc. which was published in the *American Naturalist* in 1882 as ASCOCHYTA SMILACIS E. & M. with the sporules characterized as "subhyaline" "triseptate" hence Saccardo transferred it to Stagonospora in the *Sylloge Fungorum.* In Wisconsin the sporules are usually hyaline and continuous when collected but colored and uniseptate sporules occur in some pycnidia. The sporules as ordinarily found in the pycnidia appear immature and the spots soon become lacerate and the tissue disintegrates. As septation so often comes but with maturity it was assumed that the parasite is the one that Ellis & Martin were dealing with. For further information the type specimen of ASCOCHYTA SMILACIS E. & M.

was sought but without success as it is not in the Ellis herbarium in New York or at Cambridge or Washington. Dr. Seaver kindly sent a portion of a specimen in the Ellis herbarium labeled ASCOCHYTA SMILACIS E. & M. which is in the state usually found with hyaline continuous sporules. It was on *Smilax hispida* collected in Ohio by Kellerman. Archer states that in a culture from *Smilax hispida* "some of the spores were hyaline and 1-celled but most were 1 or 2-celled and brownish in color." (*The Fungi of Iowa parasitic on Plants*, p. 434.) Spores having a median septum sometimes develop later a septum in each cell and it may have been this condition that led Ellis & Martin to describe the sporules as triseptate considering that to be the mature state (compare STAGNOSPORA BAPTISIAE (E. & E.) Davis "Notes" XVII, p. 295). Of PHYLLOSTICTA SMILACIS E. & E. the authors stated: "Specimens occur with uniseptate spores (*Ascochyta*) but usually there is no septum." They also stated: "This has been observed on various smooth-leaved species for twenty years or more but does not appear to have been described." (*Bull. Torr. Bot. Club* 27: 575 (1900).) PHYLLOSTICTA SMILACIS E. & M. appears to have been a herbarium name, at least I have seen no published description of it except in *North American Phyllostictas* 221 where PH. SMILACIS E. & E. is given as a synonym. Of this Ellis & Everhart state: "This species is found on various species of *Smilax* in different parts of the country and varies considerably in size and shape of the sporules. . . ." SPHAEROPSIS SMILACINA Pk. (33d Report, p. 24) was placed in this group by Dearness and taken as the type with the binomial PHYLLOSTICTA SMILACINA (Pk.) Dearness (*Mycologia* 9: 351.) This was referred to Phoma by Saccardo (*Syll. Fung.* 3: 160) ASCOCHYTA SMILACIS E. & E. was described as having smoky-hyaline, uniseptate sporules 6-8 x 4μ (*Journ. Mycol.* 8: 12.) ASCOCHYTA CONFUSA E. & E. was described as having smoky-hyaline sporules 7-12 x 3½-4½μ. To the description is added the statement: "ASCOCHYTA SMILACIS E. & M. Am. Nat. Dec. 1882, p. 1002 has sporules 11-22 $\times$ 6-7μ." Septation is not mentioned in the description of *A. confusa*. Of DIPLODIA SMILACINA Berk. on dead tendrils or branches of Smilax from Ohio and North Carolina little seems to be known in America. European specimens have been referred to it. SPHAEROPSIS SMILACIS E. & E. on dead stems of Smilax develops sporules similar to those that

are found on leaf spots. From their examination of a specimen of this species Gilman & Archer reported: "comparatively few of the spores were brown, still fewer were 1-septate, the majority were hyaline with granular contents thereby resembling the spores that are produced in the leaf spots." This appears to be about what one might expect from material not wholly mature. Of the variety *latispora* Pk. on dead branches of *Smilax hispida* Dearness stated: "Exceptional spores vary from 12-25μ in length and in shape from globose to oblong-elliptic."

From examination of collections on living leaves of *Smilax herbacea* from Canada, sent to him by Dr. John Dearness, Bubak published the following species (*Hedwigia* 58: 15 *et seq.* (1917)):

PHYLLOSTICTA LONDONENSIS Bubak & Dearness	Sporules 4.5-7.5 $\times$ 2.5-3.5μ
PHYLLOSTICTA PELLUCIDA B. & D.	" 5-7.5 $\times$ 2-3.5μ
PHYLLOSTICTA SMILACIGENA B. & D.	" 4-6 $\times$ 1.5μ
MACROPHOMA PELLUCIDA B. & D.	" 15-20 $\times$ 4-5.5μ
MACROPHOMA SMILACIS (E. & E.) B. & D.	" 16-28 $\times$ 4-8μ
ASCOCHYTA LONDONENSIS B. & D.	" 11-15 $\times$ 3.5-4μ
ASCOCHYTA FUSCOPAPPILATA B. & D.	" 15-22 $\times$ 2-3μ
ASCOCHYTA SMILACIGINA B. & D.	" 19-28 $\times$ 4-8μ
STAGONOSPORA PELLUCIDA B. & D.	" 20-25 $\times$ 3.5-4μ
STAGONOSPORA SMILACIGENA B. & D.	" 17-24 $\times$ 4-7μ
SPHAERELLA PELLUCIDA B. & D.	
PLEOSPHAERULINA CANADENSIS B. & D.	

The character of the spots, as described, is similar in all of these. Bubak suggested that MACROPHOMA SMILACIS (E. & E.) B. & D. may be conspecific with SPHAEROPSIS SMILACINA Pk. which was referred to Phoma, not Phyllosticta, by Saccardo in the *Sylloge Fungorum* 3: 160 where *Sphaeropsis brunneola* B. & C. on branches of *Smilax rotundifolia* was also referred to Phoma. Spots similar to those on Smilax are sometimes abundant on leaves of *Oakesia sessilifolia* but are largely sterile at the time when they have been observed. The pycnidia which they bear are those of PHYLLOSTICTA OAKESIAE Dearn. & House, and this seems to be closely related to the form on Smilax. The

condition on both hosts suggests that the thin leaves are not good substrates for full development. What is probably a more mature state of this was given the name DIPLODIA UVULARIAE n. sp. in "Notes" I, p. 87. This has brown, uniseptate sporules 12-20 × 6-7μ. A form on *Uvularia grandiflora* with smaller sporules was given the name PHYLLOSTICTA DISCINCTA in *Trans. Wis. Acad. 4th Supplementary list,* pp. 747-8. This was later referred to *Ph. cruenta* (Fr.) Kx. as a variety based on a later collection with larger sporules (16 × 6μ). A still later collection on this host has sporules about 23 × 6-7μ. What is perhaps a microconidial state of DIPLODIA UVULARIAE on *Uvularia grandiflora* was recorded in "Notes" V, p. 693.

It is of interest that while there is much diversity in the sporules in different collections on Smilax, Oakesia and Uvularia there is similarity in the leaf spots, except in PHYLLOSTICTA SUBEFFUSA (E. & E.) Tehon & Stout (*Mycologia* 21: 186) which does not appear to be a member of the group.

Gilman & Archer in the *Fungi of Iowa parasitic on Plants* (*Iowa State Journal of Science* 3: 433-4) included Smilax with Polygonatum and Smilacina as a host of SPHAEROPSIS CRUENTA (Fr.) Gilman & Archer. There seems to be no evidence that the sporules of PHYLLOSTICTA CRUENTA (Fr.) Kx. on Polygonatum or those of PH. PALLIDIOR Pk. on Smilacina acquire color or septation at maturity. The forms on Oakesia and Uvularia however may be conspecific with that on Smilax. MELANOPS CRUENTA was described by Petrak as the ascigerous state of PHYLLOSTICTA CRUENTA. (*Ann. Mycol.* 25: 226, not 296 as indexed.)

PHYLLOSTICTA PALLIDIOR Pk. has been given varietal rank in Wisconsin publications but there is constant difference in the sporules, no intermediates having been found. MACROPHOMA SMILACINAE Tehon & Stout (*Mycologia,* 21: 187), on *Smilacina stellata* was described as having sporules 11-22 × 3½-6μ. Spore color and septation are useful characters in classification but they sometimes cause confusion.

In "Notes" XIX, pp. 183-4 it was stated that the parasite referred to PESTALOZZIELLA SUBSESSILIS Sacc. & Ell. should find place in the Sphaerioidaceae. Judging from the description its place is in DILOPHOSPORA GERANII Schroet. Through the kindness of Dr. C. W. Dodge I have examined a Wisconsin specimen

from the Trelease herbarium at the Missouri Botanical Garden and find it to be of the same character. In Ellis & Everhart's *North American Fungi 1223* the sporules are also borne in pycnidia. P. SUBSESSILIS Sacc. & Ell. is the type species of the genus Pestalozziella. P. GERANII-PUSILLA C. Massal. is of the same character as far as can be determined from the poor specimens available. The type specimen of PESTALOZZIELLA SUBSESSILIS Sacc. & Ell. presumably in the Saccardo herbarium, should be reexamined and full development of the sporules should be observed in comparison with those of DILOPHOSPORA ALOPECURI Fr. = D. GRAMINIS Desm. as described and figured by Dr. Ernst A. Bessey in *Journal of Mycology* 12: 157-8. The setulae are distal only as stated by Schroeter.

In 1913 a parasite on leaves of *Carpinus caroliniana* was collected the character of which did not agree well with any of the genera that had been established and was described in "Notes" II, p. 107 under the binomial FUSARIUM CARPINEUM n. sp. Further notes and reference to its occurrence also on *Carya cordiformis* in small quantity were published in "Notes" XIII, p. 170 and XIV, p. 183 where it was suggested that it should be referred to Septoriopsis as that genus had been treated. Because of a previous use of the name by Fragoso and Paul this was changed to Cercoseptoria by Petrak (*Ann. Mycol.* 23: 69). In "Notes" X CYLINDROSPORIUM CARYIGENUM Ell. & Ev. was recorded as occurring in Wisconsin on *Carya cordiformis*. This species was referred to Cercosporella by von Hoehnel. The form on Carpinus and that on Carya are now considered to be conspecific and are labeled in the herbarium CERCOSEPTORIA CARYIGENA (E. & E.) n. comb.

In an article in the *Journal of Agricultural Research* 44: 139 *et seq.* entitled, "The Downy Spot Disease of Pecans," Demaree & Cole treat the fungus as a cause of disease of pecans and describe the ascigerous state as MYCOSPHAERELLA CARYIGENA (E. & E.) n. sp. In this connection it is of interest that FUSICLADIUM EFFUSUM Wint., referred to Cladosporium by Demaree, occurs on Carpinus as well as on Carya ("Notes" XVI, p. 285-6).

AECIDIUM MESADENIAE Arth. on *Cacalia reniformis* was recorded in the provisional list as A. COMPOSITARUM. The only Wisconsin collection was made in Kenosha Co. 1894. The locality is in south eastern Wisconsin, not north eastern as given in *North American Flora.*

ADDITIONAL HOSTS FOR WISCONSIN

ALBUGO CANDIDA (Pers.) O. Kuntze
On *Brassica juncea.* Madison (I. E. Melhus).

PLASMOPARA HALSTEDII (Farl.) Berl. & De Toni
On *Eupatorium purpureum.* Blue River. Killing the leaves which bear saprophytes, especially Alternaria.
On *Helianthus giganteus.* Westby.

MICROSPHAERA ALNI (Wallr.) Wint.
On *Lonicera oblongifolia.* Wind lake, Racine Co.

ERYSIPHE CICHORACEARUM DC.
On *Verbena hastata.* Madison.

PHYLLACHORA VULGATA Theiss. & Syd.
On *Muhlenbergia tenuiflora.* New Glarus.

DAVISIELLA ELYMINA (Davis) Petr. occurring in the locules of Phyllachora on Elymus was described as having sporules 7-10 × 2½-3μ ("Notes" V, p. 701). Petrak from examination of Wisconsin material gave the sizes of the sporules as 8-13 × 3-4½μ (*Ann. Mycol.* 22: 134). In "Notes" XIII, p. 166 there was reference to a form on Calamagrostis with sporules 10-20μ in length. In a collection from De Soto Sept. 2, 1932 on *Muhlenbergia racemosa* the sporules are 10-16 × 2-3μ. A collection on *Oryzopsis asperifolia* from Crivitz Aug. 25, 1931 shows sporules 12-20 mostly about 17μ long, nucleate but not yet septate. DAVISIELLA DOMINGENSIS Petr. & Cif. was described as having conidia 13-20 × 2-2½μ (*Ann. Mycol.* 30: 277). In collections on *Andropogon furcatus* from Sauk Co. (Greene & Davis) the sporules are 3- septate.

SEPTORIA DIDYMA Fckl. var. SANTONENSIS Pass. (MARSONIA SANTONENSIS (Pass.) Bubak).
On *Salix fragilis.* Princeton. This is quite different in appearance from the type as represented in Wisconsin on *Salix longifolia* and from Fuckel's *Fungi rhenani 1677.* The spots are angular, limited by the veinlets but confluent, dark brown becoming cream color or sordid white, the pycnidia sparse and imperfect. The sporules measured were 23-33 × 2½-3½μ uniseptate. In August 1933 this was collected south of Black Earth on *Salix alba* with well developed pycnidia the sporules, discharged in cirrhi on both leaf surfaces, 3-4μ in diameter.

SEPTORIA RUMICICOLA Allesch.

On *Rumex mexicanus.* Madison. This name was proposed to replace S. RUMICIS Ellis on the supposition that it is distinct from S. RUMICIS Trail. (*Rabh. Krypt. Fl. Die pilze* 6: 848).

GLOEOSPORIUM SALICIS West. has been collected at Omro on a host identified as *Salix lucida* which is possibly a hybrid with *S. fragilis.*

MARSSONINA MARTINI (Sacc. & Ell.) Magn.

On *Quercus bicolor.* Blue River.

STAGONOSPORA MELILOTI (Lasch) Petr.

On *Melilotus officinalis.* This parasite has become quite common on *M. alba.*

CYLINDROSPORIUM CRESCENTUM Barth.

On *Pastinaca sativa Westby.* The conidia have a median septum.

RAMULARIA PRATENSIS Sacc.

On *Rumex britannica.* Omro.

CERCOSPORA PANICI Davis

On *Panicum Boscii.* Crivitz. I have not had an opportunity to compare this with *C. fusimaculans* Atk.

CERCOSPORA DESMODII Ell & Kell.

On *Desmodium nudiflorum.* Durand.

UROMYCES PLUMBARIUS Pk.

Aecia on *Oenothera rhombipetala.* Blue River.

PUCCINIA MUHLENBERGIAE Arth. & Hol.

On *Muhlenbergia tenuiflora.* New Glarus.

An Aecidium on *Desmodium grandiflorum* occurring with Aecidium on Amphicarpa on Ferry bluff in Sauk Co. is thought to be connected with PUCCINIA ANDROPOGONIS Schw.

PUCCINIA RUBIGO-VERA (DC.) Wint.

Telia on *Elymus striatus.* New Glarus.

PUCCINIA HEUCHERAE (Schw.) Diet.

On *Heuchera sanguinea* (cult.). In a neglected rock garden at Baraboo.

CRONARTIUM RIBICOLA F. de W.

On *Ribes nigrum* (cult.). Sturgeon Bay (E. C. Blodgett). This locality is in north eastern Wisconsin.

ADDITIONAL SPECIES

not previously recorded as occurring in Wisconsin.

PHYLLACHORA MELICAE Dearn. & House

On *Melica striata.* Crivitz. Asci 65-70μ spores 9-10 $\times$ 5-6½μ. As stated by the authors this is near PHYLLACHORA VULGATA Theiss & Syd. and perhaps not distinct from PH. GRAMINIS (Pers.) Fckl. Collection of immature material on this host was referred to in "Notes" VIII, p. 418.

DERMATEA PHYLLOPHILA Pk.

Specimens on needles of *Abies balsamea* from Door County have been referred to this species.

PHOMOPSIS CALLISTEPHI Tehon & Daniels.

On *Callistephus chinensis* (cult.). Madison, Randolph and Milwaukee. (L. R. Jones & Regina S. Riker.)

From a scanty collection of living leaves of an undetermined species of Panicum from Crivitz the following notes were made: Spots fusoid, dark purple with an arid whitish center; pycnidia in the arid portion few, dark, depressed-globose thick-walled, opening by a pore, 100-130 $\times$ 80-100μ; sporules hyaline, cylindrical to fusoid-cylindrical, straight, becoming 3-septate, 24-30 $\times$ 3½ —5μ. This has not been determined.

A poorly developed Septoria on *Heliopsis scabra* was collected at Coon Valley in August and has been referred to SEPTORIA HELIOPSIDIS Ell. & Dearn. The sporules are but about 1μ thick. In the infected leaves are also what appear to be immature perithecia.

SEPTORIA KRIGIAE Dearn. & House

On scapes and on involucral bracts of *Krigia virginica.* Mazomanie June 20, 1932. The black firm-walled pycnidia are prominent often breaking through the epidermis.

COLLETOTRICHUM HEPATICAE Pk.

On *Hepatica acutiloba* on dead spots caused by *Plasmopara pygmaea fusca* (Pk.) Davis. This is very doubtfully parasitic.

A specimen on dead leaves of (?) Elymus was collected at Racine June 25, 1888 and labeled *Vermicularia denudata* Schw. As it was not recognized as a parasite it was not recorded. Examination of the leaves shows that the acervuli are on light colored spots. This should now be referred to Colletotrichum but the specific name and the parasitism are open to question. The conidia seen were about 20 × 3μ.

CYLINDROSPORIUM SOLITARIUM Heald & Wolf

On *Robinia Pseudo-acacia.* Princeton. Perhaps a form of the species on this host in Europe which has been referred to various genera.

BOTRYTIS HYPOPHYLLA Ell. & Kell. was described as occurring on leaves of *Teucrium canadense* which also bore *Cercospora "ferruginea."* Manneval reported it on *Cercospora hydropiperis* on *Polygonum hydropiper,* (*Univ. of Mo. Studies* 1: 85.) In Wisconsin it appeared to be parasitic on *Cercospora clavata* on leaves of *Asclepias incarnata.*

CERCOSPORA SETARIICOLA Tehon & Daniels

On *Setaria glauca.* Black Earth. In this collection the fasciculi are not usually as large as in the type as described and sometimes occur on the upper surface of the spots. Slender curved conidia up to 150μ in length are found. The conidia become pluriseptate.

MELAMPSORA EUPHORBIAE-GERARDIANAE W. Mueller

Uredo on *Euphorbia commutata.* Beloit (Fassett).

PHRAGMIDIUM ROSAE-ARKANSANAE Diet.

Uredinia and telia on *Rosa pratincola.* Black Earth.

PUCCINIA BATESIANA Arth.

Aecia and telia on *Heliopsis scabra* in "Spring Coulee" between Westby and Coon Valley.

CERCOSPORA SENECIONICOLA n. sp.

Spots indeterminate, hypophyllous, becoming ferruginous; conidiophores hypophyllous, fasciculate on small scattered brown stromata, usually curved or tortuous and nodulose, more or less brown or fuscous, sometimes branched, 15-30 × 3μ conidia hyaline obclavate-cylindrical, usually straight, septate, 30-80 × 2½-3½μ. On *Senecio aureus.* Coon Valley, Wisconsin,

August 13, 1932. Apparently distinct from CERCOSPORA SENECIONIS Ell. & Ev.

CERCOSPORA SENECIONICOLA sp. nov.

Maculis indeterminatis, hypophyllis dein ferrugineis; conidiophoris hypophyllis, fasciculatisque in parvis stromatibus brunneis dispersis, plerumque curvatis vel tortis alque nodulosis, plus minus brunneis vel fuscis, interdum ramosis 15-30 × 3μ; conidiis hyalinis, obclavatis-cylindratis, plerumque rectis, septatisque, 30-80 × 2½-3½μ on *Senecionibus aureis.*

UNIVERSITY OF WISCONSIN HERBARIUM, MADISON, WISCONSIN
April, 1934.

ADDENDA

July 20, 1911 a Cercospora on *Spiraea salicifolia* was collected at Spooner and a description written under the binomial *Cercospora laxipes* n. sp. As there was some question as to its being a form of *Cercospora rubigo* Cke. & Harkness the description was published in the Appendix to the Provisional List as *Cercospora rubigo* Cke. & Hark. (?) Another collection from Nekoosa was described and the original description repeated in "Notes" VIII, pp. 428-9. This is now considered to be distinct and labeled CERCOSPORA LAXIPES n. sp. Another collection was made at Caryville.

In "Notes" XVI, p. 292 an Aecidium on *Galium tinctorium* was published as *Aecidium sparsum* n. sp. This binomial is antedated by *Aecidium sparsum* Haszlinsky 1877 and Dr. J. C. Arthur considers that the Aecidium is not distinct from *Aecidium houstoniatum* Schw. which as it occurs on *Houstonia coerulea* was connected with a Uromyces on Sisyrinchium by Sheldon and by Arthur. Sheldon however failed to demonstrate the connection with Aecidium on *Houstonia purpurea.* In Wisconsin Aecidium occurs on *H. longifolia* which is closely related to *H. purpurea* but no Uromyces has been seen on Sisyrinchium in the state although it has been looked for where the Aecidium occurred. An attempt to infect Sisyrinchium with aeciospores from *H. longifolia* in Wisconsin was without result. "Notes" XVI, pp. 283-4.

In the suppl. list p. 171 *Leptothyrium periclymeni* var. *americanum* E. & E. (*Trans. Wis. Acad.* **9**: 171) was recorded. This

is now referred to *Kabatia lonicerae* (Hark.) Hoehn. but the Wind Lake, Racine county specimen is *Kabatia mirabilis* Bubak. (*Jour. Mycol.* 6: 116.)

Puccinia bartholomaei Dict. has been kept distinct from *P. vexans* Farlow because of the absence of amphispores and the development of aecia on Asclepiadaceae while the aecial stage of *P. vexans* was unknown. Development of aecia on *Asclepias tuberosa* and *A. syriaca* in the greenhouse through the agency of teliospores of *P. vexans* indicates that *P. bartholomaei* should be considered to be a form of *P. vexans* in which amphispores are not developed.

Phyllosticta similispora Ell. & Davis was described as occurring on *Solidago rigida.* It was later described as *Leptothyrium tumidulum* Sacc. on the same species of host. In Notes XVIII it was stated that hypophyllous pycnidia pushed into the mesophyl and were globose. The species has since been found on *Solidago serotina* which has firmer leaves and the pycnidia are similar on both leaf surfaces. It is perhaps best then to follow Saccardo and refer the species to Leptothyrium. If one takes the older specific name the binomial would be LEPTOTHYRIUM SIMILISPORUM (Ell. & Davis) n. comb.

ADDITIONAL HOSTS

BREMIA LACTUCAE Regel. On *Hieracium aurantiacum.* Mirabel and Stoney Creek, Kewaunee Co. Greene & Davis.

PERONOSPORA HEDEOMATIS Kell. & Su. On *Hedeoma hispida.* Blue River. Greene & Davis.

SPHAEROTHECA HUMULI (DC.) Burr. On *Potentilla fruticosa.* Bailey's Harbor.

ERYSIPHE POLYGONI (DC.) On *Polygonum ramosissimum.* Lone Rock. Perithecia not mature.

STAGONOSPORA MELILOTI (Lasch) Petr. On *Trifolium hybridum.* Coon Valley. (F. R. Jones.) Very scanty.

USTILAGO UTRICULOSA (Nees) Tul. On *Polygonum Careyi.* Tomah.

CRONARTIUM RIBICOLA F. deW. On *Ribes nigrum* (cult.). Sturgeon Bay. (E. C. Blodgett.)

TRANZSCHELIA PRUNI-SPINOSAE (Pers.) Diet. Aecia on *Anemone caroliniana.* Hager City. (Fassett & Hanson.)

PUCCINIA ARGENTATA (Schultz) Wint. Aecia on *Adoxa Moschatellina.* Ontario, Wis. (N. C. Fassett.)

PUCCINIA EXTENSICOLA HIERACIATA (Schw.) Arth. Aecia on *Hieracium longipilum.* Blue River. (Greene & Davis.)

CERCOSPORELLA NIVEA Ell. & Barth. On *Solidago hispida.* Hancock.

SPHAEROTHECA HUMULI FULIGINEA (Schlecht) Salm.
On *Bidens cernua.* Black Earth.
On *Bidens vulgata.* Muscoda.

STAGONOSPORA MELILOTI (Lasch) Petr.
On *Medicago sativa* (cult.). Madison. (F. R. Jones.)

CERCOSPORELLA NIVEA Ell. & Barth.
On *Solidago hispida.* Hancock.

SOROSPORIUM SYNTHERISMAE (Pk.) Farl.
On *Panicum dichotomiflorum* and *Panicum capillare.* Muscoda.

MELAMPSORA ABIETIS-CANADENSIS (Farl.) C. A. Ludwig.
(*M. populi-tsugae,* "Notes" IV, p. 676.)
Telia on *Populus balsamifera.* Bailey's Harbor.

PUCCINIA GRAMINIS Pers.
Uredia on *Cotabrosa aquatica.* Hudson. (Fassett.)

ADDITIONAL SPECIES

CYLINDROSPORIUM ROBINIAE (Lib.) Died. *Septoria curvata* (Rabh. & A. Braun) Sacc. is considered to be a synonym.
On *Robinia pseudoacacia.* Muscoda. In this collection the sporules are 2-4μ thick and 3-10 septate. The pycnidia are inconspicuous.

SEPTORIA SONCHIFOLIA Cke.
On *Sonchus asper.* Hancock. Spots definite, becoming sordid white usually 3-6 mm., on dead areas; sporules 23-33 $\times$ 1-1½μ.

MELANOPSICHIUM AUSTRO-AMERICANUM (Speg.) Fisch.
On *Polygonum lapathifolium.* McCartney. (Fassett & Evans.)

PUCCINIASTRUM SPARSUM (Wint.) Fisch.
Uredia on *Arctostaphylos uva-ursi.* Bailey's Harbor.
The American records of this rust are confined to the Pacific coast region. There is no record of its occurrence in America on this host.

RAVENELIA EPIPHYLLA (Schw.) Diet.
Uredia and telia on *Tephrosia virginiana.* Muscoda.
Apparently spreading from the railroad right of way.

PUCCINIA HYSSOPI Schw.
On *Agastache scrophulariaefolia.* Viroqua. A single station in western Wisconsin.

PHYLLACHORA BOUTELOUAE Rehm. On *Bouteloua hirsuta.* Poynette. (Greene & Davis).

Of a collection on *Artemisia serrata,* Tomah, September 25, 1935 the following notes were made: Spots dark reddish brown, angular, variable in size, pycnidia amphigenous, globose, ca. 100μ; sporules curved, acute mostly 50-70 $\times$ 3-4μ. On leaves of *Artemisia serrata,* Tomah, Wisconsin, September 25, 1935. The majority of the pycnidia have undifferentiated contents. This is labeled in the herbarium as SEPTORIA ARTEMISIICOLA n. sp. A very destructive parasite of the leaves of *Iris lacustris* has been observed at Bailey's Harbor. In September leaves were brought to Madison and over-wintered outside. In the spring the perithecia developed asci 50-60 $\times$ 13μ and uniseptate hyaline ascospores 17 $\times$ 5-7μ. The material was lost so no description of this Mycosphaerella is published. Apparently no conidia are developed.

COLLETOTRICHUM VICIAE Dearn. & Overholts. On *Vicia villosa.* Arena and Muscoda. Greene and Davis.

PHYLLOSTICTA ANEMONICOLA Sacc. & Syd. On *Anemone? canadensis.* Sauk Co. Oct. 15, 1935.

PUCCINIA SIMULANS (Pk.) Barth. Uredia on *Sporobulus cryptandrus.* Spring Green, Muscoda, and Lone Rock. In village streets.

OPHIOCLADIUM HORDEI Cav. On *Phalaris arundinacea.* Lone Rock and Durand. Distinguished from Ovularia by the tortuous conidiophores. Spring Green and Durand.

FUSICLADIUM ROBINIAE Shear. On seedling *Rubinia pseudoacacia.* Lone Rock.

UNIVERSITY OF WISCONSIN HERBARIUM,
MADISON, WISCONSIN.
FEBRUARY, *1937.*

PRELIMINARY REPORTS ON THE FLORA OF WISCONSIN. XXV. ARALES

NORMAN C. FASSETT

University of Wisconsin

(*The Lemnaceae in collaboration with* LAWRENCE E. HICKS)

This report is based on the material in the Herbarium of the University of Wisconsin, and of the Milwaukee Public Museum. For the loan of the latter, the writer is indebted to Mr. A. M. Fuller.

ARACEAE—ARUM FAMILY

ARISAEMA TRIPHYLLUM (L.) Schott. Jack-in-the-Pulpit. (Fig. 1). Probably throughout the state. Forma VIRIDE (Engler) Farwell, Am. Mid. Nat. xii. 53 (1930), with the spathe entirely green, is found occasionally.

A. DRACONTIUM (L.) Schott. Green Dragon. (Fig. 2). Much less common, in wet woods and river-bottoms across the southern half of the state. Not usually found where the Jack-in-the-Pulpit grows.

CALLA PALUSTRIS L. Water Arum. (Fig. 3). In bogs, mostly northward and eastward. Southwestward, in the Driftless Area (on the map enclosed by a broken line), where bogs are rare and becoming dry, it is occasionally found persisting after the ground has become fairly firm.[1]

SYMPLOCARPUS FOETIDUS (L.) Nutt. Skunk Cabbage. (Fig. 4). Probably throughout the state; the apparent rarity in the northern part of the state may be due to lack of collecting in that region in the early spring.

ACORUS CALAMUS L. Sweet Flag. (Fig. 5). Mostly northward and eastward; apparently nearly absent from the Driftless Area (on the map enclosed by a broken line) except rarely along the Wisconsin and Mississippi Rivers.

LEMNACEAE—DUCKWEED FAMILY

The material in the Herbarium of the University of Wisconsin has been identified by Dr. Lawrence E. Hicks, who has also supplied the sketches here reproduced. The maps show the ranges very inadequately, for these plants are seldom taken by most collectors; they are presented in hope of stimulating activity which will fill the gaps and help to give a more complete picture of the occurrence of these plants.

The following key is adapted from one made by Dr. Hicks; names of species which have not been found in Wisconsin but may yet be collected are in brackets.

---

[1] See Hansen, The Tamarack Bogs of the Driftless Area of Wisconsin, Bull. Pub. Mus. of City of Milwaukee, vii, no. 2: 296 (1933).

a. Plants with roots *b*

b. Each plant of a group with several roots in a fascicle from the the node; plants usually red below and with a red eye spot (the node) above .....*Spirodela polyrhiza* (L.) Schleid.

b. Each plant of a group with but one root *c*

c. Plants submerged, each feather-shaped with the basal portion narrowed into a petiole-like stem .....*Lemna trisulca* L.

c. Plants usually floating, each oval to oblong, without petiole-like stems, when connected appearing sessile *d*

d. Plants symmetrical or nearly so *e*

e. Plants deep green, obscurely 3-veined, convex on both surfaces, cavernous throughout, appearing medium thick when pressed .....*Lemna minor* L.

e. Plants pale green, obscurely 1-veined, flat on lower surface, cavernous in the middle portion only, appearing membranous when pressed .....[*Lemna minima* Philippi.]

d. Plants asymmetrical *f*

f. Plants obliquely obovate, medium thick, usually deep green with some reddish purple, distinctly 3-veined *Lemna perpusilla* Torr.

f. Plants linear-oblong, thin, pale green, obscurely 1-veined .....[*Lemna valdiviana Philippi.*]

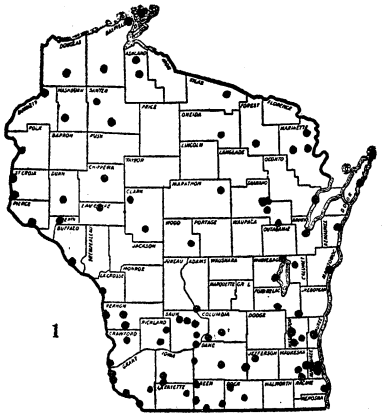
a. Plants without roots *g*

g. Plants globose or nearly so, not punctate, loosely cellular; upper surface convex with 3 usually inconspicuous papules *Wolffia columbiana* Karst.

g. Plants more or less flattened above and gibbous beneath, brown-punctate, more compactly cellular *h*

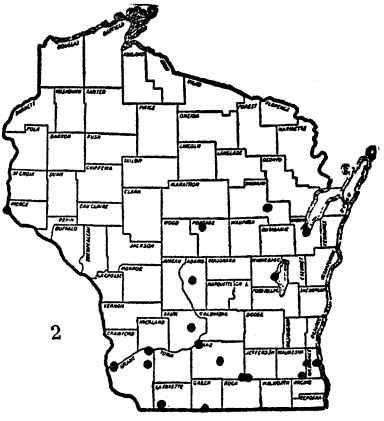
h. Plants round ovate, strongly gibbous, slightly asymmetrical [*Wolffia papulifera* Thompson.]

h. Plants more or less oblong with an upturned acute tip (peanut-shaped), slightly gibbous, symmetrical *Wolffia punctata* Grisebach



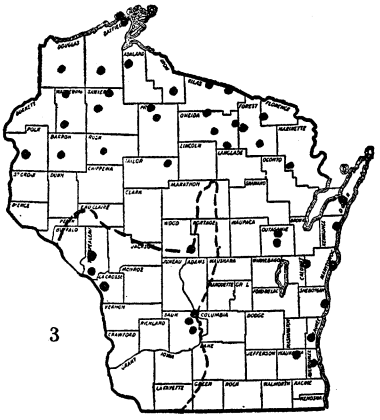
1

Arisaema triphyllum



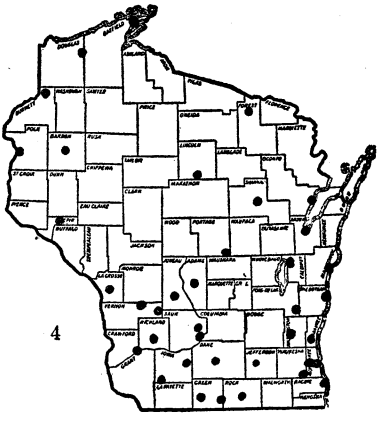
2

Arisaema Dracontium



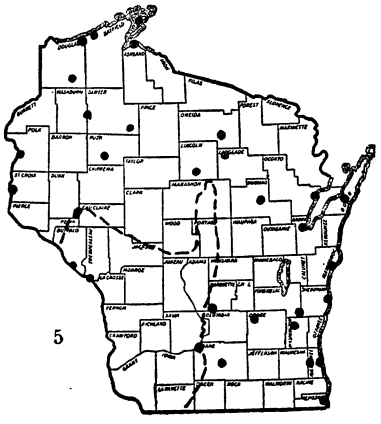
3

Calla palustris



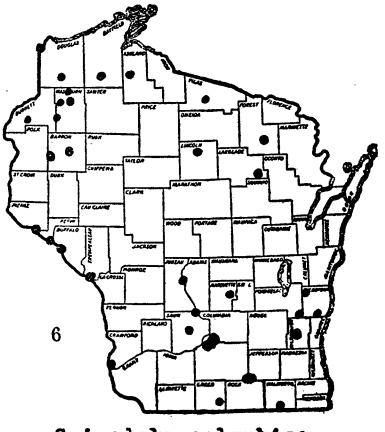
4

Symplocarpus foetidus



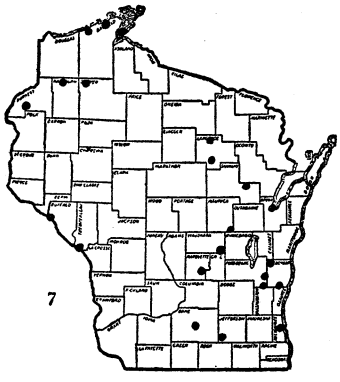
5

Acorus Calamus

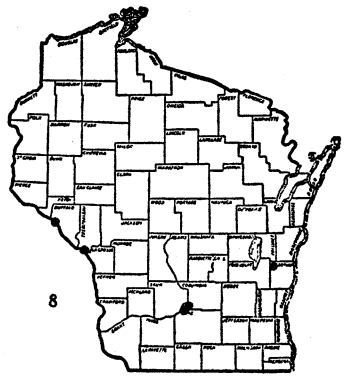


6

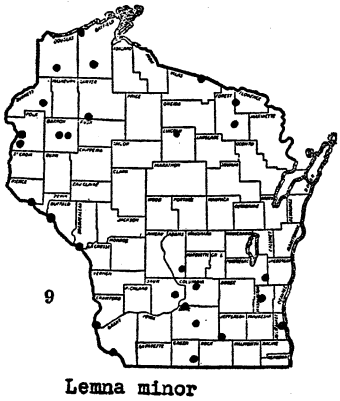
Spirodela polyrhiza



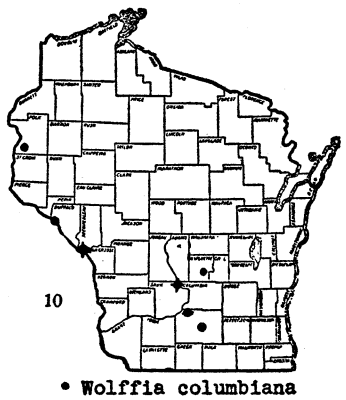
Lemna trisulca



Lemna perpusilla



Lemna minor

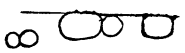


• Wolffia columbiana

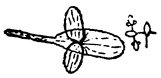
+ Wolffia punctata

Spirodela polyrhiza

Lemna minima



Wolffia columbiana



Lemna trisulca

Lemna perpusilla

Wolffia punctata

Lemna minor

Lemna valdiviana

Wolffia papulifera

PRELIMINARY REPORTS ON THE FLORA OF WISCONSIN. XXVI. CONVOLVULACEAE.

SIDNEY O. FOGELBERG

The maps of *Cuscuta* and *Convolvulus* are compiled from specimens in the herbarium of the University of Wisconsin and the herbarium of the Milwaukee Public Museum. The writer gratefully acknowledges the guidance of Dr. Fassett throughout the course of the work, the courtesy of Mr. Fuller for the loan of the Museum specimens and the suggestions of Dr. E. T. Wherry in regard to the problem of *C. spithamaeus* var. *stans*.

CUSCUTA

a. Flowers subtended by several closely appressed bracts; styles very slender and much longer than the ovary.
   b. Bracts squarrose; floral masses tightly twined about host like a rope ..... *C. glomerata*

   b. Bracts not squarrose, generally cuspidate; floral masses looser, irregular ..... *C. cuspidata*

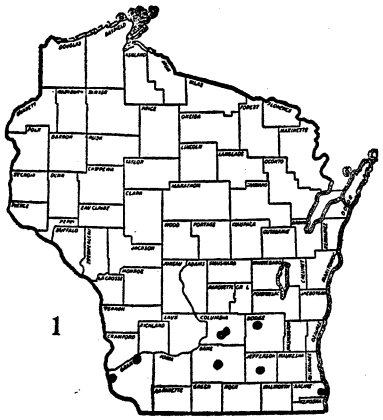
a. Flowers not immediately subtended by several bracts; styles shorter than or only slightly longer than the ovary.
   c. Corolla lobes acute.
      d. Tips of corolla lobes inflexed; breadth of infra-staminal scales exceeding or about equalling the length.
         e. Calyx lobes acute, not overlapping; infra-staminal scales reduced to two small wings near the base of the corolla tube; whole perianth fleshy, papillose ..... *C. Coryli*

         e. Calyx lobes obtuse, overlapping to form angles, giving the calyx a pentagonal appearance; infrastaminal scales very prominent, becoming exserted; median portions of perianth segments generally glandular ..... *C. pentagona*

      d. Tips of corolla lobes not inflexed; flowers not fleshy or glandular; infrastaminal scales oblong, several times as long as broad, truncate or bifid ..... *C. Polygonorum*

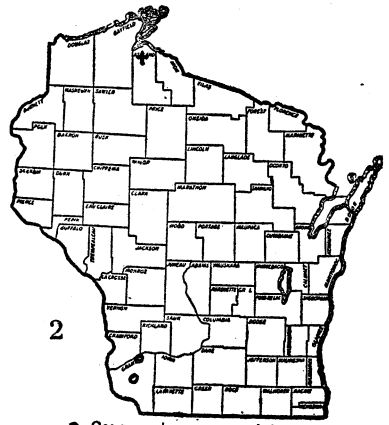
   c. Corolla lobes obtuse
      f. Capsule capped by the withered corolla; infrastaminal scales narrow, generally less than twice the breadth of the anther; flowers generally 4-parted ..... *C. Cephalanthi*

      f. Corolla not carried to the apex of the capsule; infrastaminal scales generally more than twice the breadth of the anther; flowers mostly 5-parted.
         g. Infrastaminal scales rounded or truncated and usually about as long the the corolla tube; styles about as long as the ovary or somewhat shorter; capsules seldom as much as 6 mm. in diameter ..... *C. Gronovii*



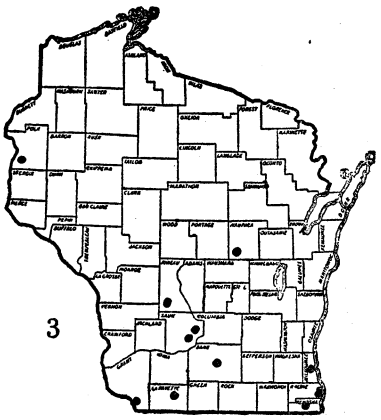
1

Cuscuta glomerata



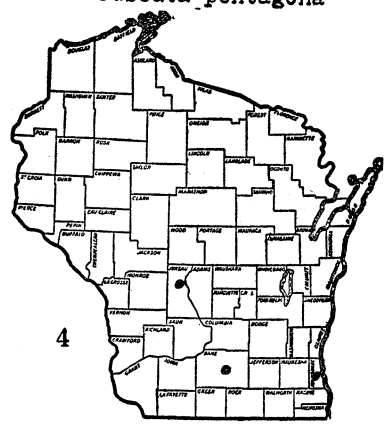
2

• Cuscuta cuspidata
+ Cuscuta curta
o Cuscuta pentagona



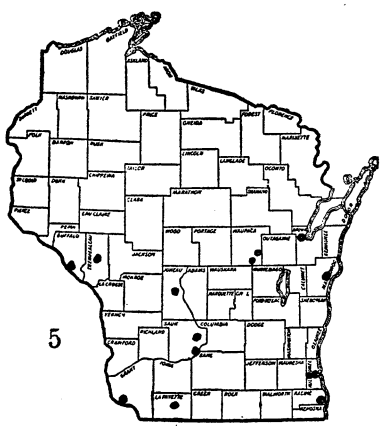
3

Cuscuta Coryli



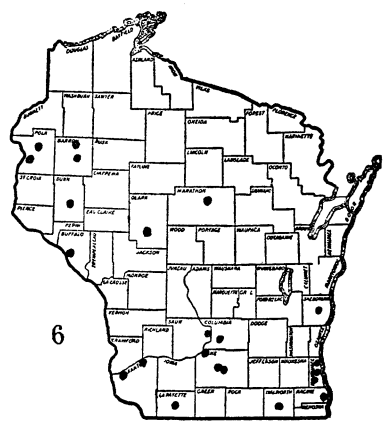
4

Cuscuta Polygonorum



5

Cuscuta Cephalanthi



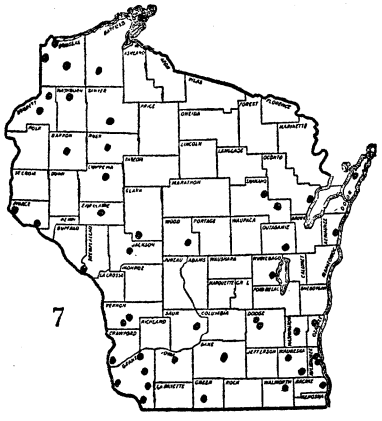
6

Cuscuta Gronovii

g. Infrastaminal scales much shorter than the corolla tube, bifid or truncate; styles mostly considerably shorter than the ovary; capsules large, often 6 mm. or more in diameter ..... *C. curta*

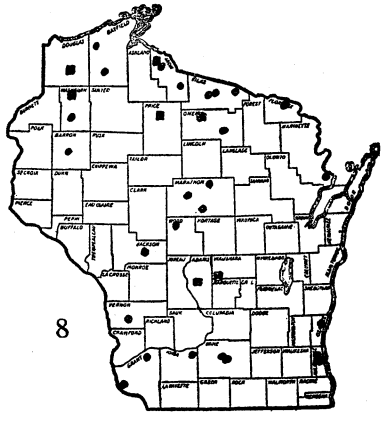
C. glomerata Choisy. (Fig. 1) Across the southern end of the state.

C. cuspidata Engelm. (Fig. 2, dot) The only specimen is one from Boscobel, Grant County, collected by C. H. Sylvester, July 31, 1886, now entered as No. 22107 in the Public Museum, Milwaukee.



7

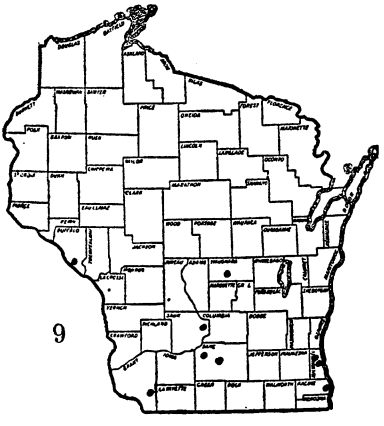
Convolvulus sepium



8

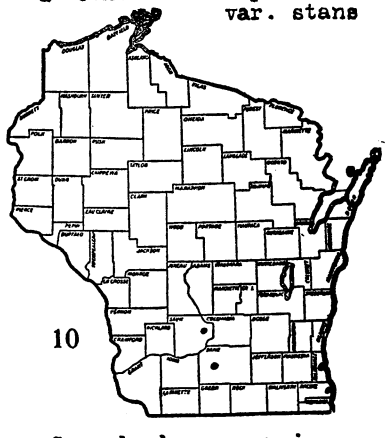
• Convolvulus spithamaeus

▪ Convolvulus spithamaeus var. stans



9

Convolvulus arvensis



10

Convolvulus arvensis var. obtusifolius

C. Coryli Engelm. (Fig. 3) Mostly southern but one collection from Polk County. Quite common.

C. pentagona Engelm. The only representative of this species seen from the state is the collection of N. C. Fassett from a sandstone ledge three miles south of Mt. Ida, Grant County. (Fig. 2, circle)

C. Polygonorum Engelm. (Fig. 4) Southern. Not common.

C. Cephalanthi Engelm. (Fig. 5) Common in the southern half of the state.

C. Gronovii Willd. (Fig. 6) The most common species.

C. curta (Engelm. Rydberg. (Fig. 2, cross) Closely related to *C. Gronovii* but very rare, the only collection being from White River, Ashland County, L. S. Cheney, July 11, 1896, No. 4738.

CONVOLVULUS

C. sepium L. (Fig. 7) Very common except in the northeastern part of the state. No convincing specimens of *C. sepium* var. *pubescens* (Gray) Fernald have been seen although a few specimens are more or less pubescent and some have less hastate leaf blades with auricles more rounded than those of typical *C. sepium.*

C. spithamaeus L. (Fig. 8, dots) Throughout the state. Apparently most prevalent in the northeastern part of the state.

C. spithamaeus var. **stans** (Michx.) n. comb. (Fig. 8, squares) *Volvulus spithomaeus* var. *stans* (Michx.) Farwell as to name only. *C. stans* Michx. Fl. Bor. Am. 1:136. 1803, not Wherry, Torreya 29:105. 1929. *C. camporum* Greene in part. Less common; in the northern part of the state and on the central plain. This plant may be distinguished from the preceding by the leaf-blades which are covered with a dense, white, velvety pubescence and tend also to be more cordate at base. This variety is found across the northern edge of the range of *C. spithamaeus* as shown by Wherry, Proc. Penn. Acad. Sci. 7.1933. The characters cited above are mentioned in Michaux's description and are emphasized by Wherry as the salient ones in distinguishing this plant. Distribution also indicates that they are the significant characters while the characters given by Greene,

such as position of flowers and tendency to twine, appear to have no diagnostic value in specimens examined.

C. arvensis L. (Fig. 9) Southward from Buffalo and Waushara Counties. Many specimens intergrade between this and *C. arvensis* var. *obtusifolius* Choisy (Fig. 10) which is somewhat less common.

AN ACQUIRED PARTIAL IMMUNITY TO THE TOBACCO STREAK DISEASE

JAMES JOHNSON*

The disease recently described under the name of "tobacco streak"[4] has been seen for over 15 years in Wisconsin tobacco fields. Out of hundreds of plants thus observed, practically complete recovery of affected plants has been such an outstanding characteristic that the virus nature of the disease was not seriously suspected until 1933. During studies of the disease on greenhouse plants by means of artificial transmission, the same typical "recovery" occurred regularly, as in the field. Following recent studies by others[5,6] on acquired immunity to plant viruses, it appeared that "tobacco streak" might be a suitable disease in which to seek corroboratory evidence of this phenomenon in plants. A series of experiments were therefore conducted which have resulted in the conclusion that recovery from "tobacco streak" cannot be satisfactorily interpreted otherwise than as an acquired immunity or resistance to the disease on the part of affected plants.

EARLIER STUDIES

The subject of acquired immunity to disease in plants has fascinated plant pathologists for some time[2]. Little or no conclusive evidence of its existence can be said to have been established among the fungus and bacterial diseases. That it may occur among plant virus diseases has only recently been demonstrated, and we are indebted chiefly to the investigations of Price[6] and Kunkel[5] for the present interest in the problem. These writers adequately summarize the earlier, less conclusive and more fragmentary references to the subject, to which the interested reader is referred.

Price[6] in 1932 investigated tobacco ring-spot, where partial recovery from the first attack of the disease is said to be characteristic on ordinary tobacco, (*Nicotiana tabacum* L.). In other species, however, notably *Nicotiana sylvestris* (Speg. and

* Cooperative investigations of the Wisconsin Agricultural Experiment Station and the Division of Tobacco and Plant Nutrition, Bureau of Plant Industry, United States Department of Agriculture.

Comes), recovery from symptoms was found to be regular and complete. The virus is readily transmitted by plant extract to healthy individuals, which exhibit typical symptoms of the disease in a few days, after which time new leaves are formed free from symptoms. The virus is, however, present in these "recovered" leaves in high concentration, as well as in normal virulence. Reinoculation of such recovered plants in approximately the same condition as healthy control plants yields no further symptoms in the former, whereas the latter take the typical disease. Price found further that cuttings from immune plants, as contrasted to cuttings from healthy plants, retained the acquired immunity, and the virus, through three generations, but no immunity was transmitted through the seed. The presence of antibodies or the movement of any immunizing principle beyond the boundary of virus-infected tissue could not be demonstrated.

This evidence offered for the existence of acquired immunity in the case of tobacco ring-spot was perhaps not by itself entirely convincing. In 1934, however, Kunkel[5] reported results of a similar and more definite nature, using the ordinary tobacco mosaic virus and closely related strains, together with some modification in technique. It was found that, when the yellow tobacco mosaic virus ("aucuba" mosaic) was rubbed over the surface of *N. sylvestris* leaves, necrotic lesions were produced in abundance, whereas the ordinary tobacco mosaic virus produced no such necrotic lesions on this species. If, however, the ordinary mosaic virus was first rubbed over the leaves, followed 2 days later by similar inoculation with the yellow mosaic virus on the same areas, the latter failed to produce necrotic lesions. The leaves or portions of leaves inoculated with ordinary tobacco mosaic virus were evidently immunized against the necrosis from the yellow tobacco mosaic virus. It was found that the immune reaction was closely confined to the parts inoculated. Systemic immunity followed, but was closely associated with the progress of the immunizing virus. Other viruses, like those of cucumber mosaic and ring-spot, afforded no immunity to the yellow tobacco mosaic virus, but attenuated strains of the tobacco mosaic virus immunized as well as the ordinary strain of this virus.

METHODS OF INVESTIGATION

Plant virus diseases are not only generally systemic in the ordinary sense, but the virus virtually penetrates into and multiplies in every cell of the affected host. Once infected, the host normally remains so throughout its life, including all subsequent generations propagated vegetatively therefrom. Exceptions occur chiefly in hosts in which certain viruses may cause only local infection. Despite this systemic invasion, the total or partial recovery of plants from the symptoms of many virus diseases is relatively common. It should be emphasized that the recovery is from the symptom expression, not from the virus itself, which may be, and usually is, present in recovered parts in normal amount and virulence. This recovery has in most instances been rightfully attributed to environmental influences both internal and external to the host[3]. That is, the symptoms are said to be masked, and when the environment is again favorable the symptoms reappear. However, all cases of recovery do not appear to result from such environmental influences, since in some virus diseases recovery comes about apparently regardless of the environmental conditions offered. Nevertheless, while one may maintain or change the external environment with reasonable certainty as occasion demands, it is not safe to predict the effect of the internal environment of a recovered plant with respect to its predisposition to disease, following the shock and check of a disease which invades every cell. Particular caution must therefore be exercised in performing experiments on immunity and in drawing conclusions therefrom, in order to avoid confusion with such types of recovery as may be due solely to such conditions as plant age and vigor, since, contrary to general belief, the less vigorous the plant the more likely it is to tend toward recovery from a typical set of symptoms. The success of experiments may therefore depend a great deal upon the plants selected for study and the use of adequate controls. In the case of the tobacco streak virus it is also important to select suitable young infected leaves as a source of inoculum.

In the present experiments, potted plants of various ages, sizes and degrees of vigor have been used, from those just large enough to be inoculated to plants 18 inches in height. These plants were all grown in a rich greenhouse compost soil and all experimental trials were performed in the greenhouse at a tem-

perature of 80-90° F. The rubbing method of inoculation was used with freshly extracted virus from newly diseased tissue. On young plants, local and systemic necrosis usually developed in three days. The systemic necrosis affects only 2 or 3 of the young leaves. They are never killed, but remain marked by necrosis and dwarfed. Succeeding leaves show no necrosis, and usually grow to about normal size, but under the environment of the warm greenhouse they may continue to show more or less mottling[4]. Reinoculations were made either on the recovered leaves at various stages of growth or on lower leaves not previously inoculated or affected by necrosis. It may be argued that the reinoculation of leaves or plants already containing the same virus might not be expected to produce disease, but this is the logical method of determining immunity. In the cross-immunity studies, that is, by subsequent inoculation with different viruses, this objection does not hold; though, on the other hand, acquired immunity is not normally to be expected in such instances. Trials of this type are, however, of special interest from various points of view; and, in the present connection, because of their varying influences on the hosts, served particularly well as a modified form of control to the reinoculations with the streak virus.

Experimental Results

During the course of the greenhouse investigation on the streak disease of tobacco (*N. tabacum* L.) and the virus causing the disease[4], together with the subsequent more detailed studies on acquired immunity, approximately 800 plants have been inoculated with the virus, usually in separate series of five plants each, over a period of nine months. In no case has recovery from the necrotic form of the disease failed to occur, nor has a second attack of necrosis subsequently developed. In field observations of the disease, where total recovery from both necrosis and mottling is even more striking, a mild recurrence of the necrotic form of the disease on secondary or "sucker" growth may occur occasionally, apparently as a consequence of the late entrance of the virus into rapidly growing tissue.

While the presence of the virus in the recovered leaves may usually be concluded from the mild mottling which occurs on greenhouse-grown plants, inoculations have been made at vari-

ous times back to tobacco from 20 such recovered leaves. Out of 85 plants thus inoculated, 83 came down with typical streak, showing that the virus was present in approximately normal amount and concentration in these recovered leaves, since this virus is relatively sensitive to dilution[4].

In twenty-six separate series of trials, comparative reinoculations were made with the streak virus to both recovered plants and leaves of various ages, sizes, and degrees of vigor. Out of 130 plants thus inoculated, none has shown a second necrotic attack of the disease, though a few have shown some primary necrotic lesions on the inoculated leaves, where such reinoculations were made on leaves below the point of the original inoculation. Out of 130 healthy control plants inoculated at the same time and with the same inoculum, 115 came down with necrotic streak. The failure to secure 100 per cent infection occurred usually on the older, larger, and less vigorously growing controls, which are apparently somewhat less predisposed to infection and offer more natural resistance to systemic invasion of the virus. Such plants were, however, frequently infected though only to the extent of about 50 per cent of those inoculated.

In the above trials the plants selected as controls were often older, larger, and less vigorous than the previously infected plants, but in all instances systemic necrosis was secured on one or more of the controls and never on the previously infected individuals. These experimental results seem to show conclusively that tobacco (*N. tabacum*) plants previously infected with "streak" become immunized to a subsequent attack by the necrotic form of the same disease. The nature of the evidence is such that it is best demonstrated by illustrations, of which only a limited number can be presented (Figs. 1, 2, 3, 4, 5.).

The host range of the tobacco streak virus is not yet known, but not all solanaceous plants are susceptible. All species of the genus Nicotiana which have been tested have been found susceptible, but to a widely varying degree. Several forms closely related to *N. tabacum* and frequently treated as varieties of that species react in an almost identical manner to *N. tabacum,* that is, they yield typical systemic necrosis which is soon followed by "recovery." This group includes *N. tabacum* L. var. *atropurpurea,* var. *calyciflora,* var. *chinensis,* var. *laterrima,* and var. *macrophylla. N. sylvestris* Speg. and *N. repanda* W., although

not closely related to *N. tabacum,* react in the same way. In contrast with these, *N. acuminata* Grab., *N. glutinosa, N. nudicaulus* G. Watson, *N. longiflora* Cav., and *N. biglovii* Wats. typically yield no necrotic symptoms, but mottling only, from which recovery is not evident. *N. alata grandiflora* Com. and *N. sanderae* Sander. tend to yield a chlorotic type of symptom. *N. quadrivalvis* Pursh var. *multivalvis, N. paniculata* L., and *N. rustica* L. are susceptible to infection, but yield very mild if any symptoms *i.e.,* they possess a natural resistance to both the mottling and necrotic form of the disease. It is clear that acquired immunity to tobacco streak is characteristic chiefly of the necrotic form of the disease and is hence largely limited to species on which necrosis occurs.

Prior infection with several other viruses has failed to yield any definite protection against "tobacco streak". The viruses used in these trials were those of: 1, ordinary tobacco mosaic (*tobacco virus* 1); 2, ordinary cucumber mosaic (*cucumber virus* 1); 3, tobacco ring-spot; 4, potato ring-spot; 5, potato "mottle"; 6, potato veinbanding. Ordinary tobacco mosaic, which stunts and malforms the leaves of tobacco to the greatest extent, apparently offers no immunizing action, whereas the tobacco ring-spot and potato veinbanding viruses, which check growth only slightly, appear to yield a slight protection. The other viruses resembled that of tobacco mosaic in yielding little or no protection. It should be recalled in this connection that, unless some immunizing action is offered by one of two viruses present in a host, the resultant combination disease is usually more severe on the host than that caused by either virus alone.

Cross-immunity inoculation trials, *i.e.* through inoculating streak-infected plants with the above-named six viruses, yielded no evidence that the streak virus protected the plants against any of the latter viruses. It appears clear that the immunity acquired by tobacco through the streak virus is specific for this virus.

Discussion

The control of disease in man and animals through the principles of acquired immunity is common practice. In the plant kingdom virtually no progress has been made in this direction. This situation is not accidental, nor a consequence of neglect,

but is a result of the innate differences between plants and animals. Hence good examples could be offered as proof of the nonexistence of acquired immunity, and many good reasons suggested for the belief that such a phenomenon is not likely to occur in plants. The recent evidence which is accumulating with respect to acquired immunity toward plant viruses is, however, of such significance that it can no longer be seriously questioned. Whether or not it is to be regarded as of the same character and nature as the acquired immunity exhibited in animals is open to question, as has been pointed out by Kunkel[5]. Acquired immunity to tobacco streak is evidently dependent upon the presence of the virus in the tissues, and in this respect agrees with Price's and Kunkel's observations. The case of tobacco streak differs somewhat from that of tobacco ring-spot in that the recovered leaves are apparently not immune to the mild form of streak (mottling), although they are completely immune to the severe form of streak (necrosis).

It is not likely that protective inoculation of individual plants may be a practical control measure for ordinary crop plants grown annually from seed. In the case of vegetatively propagated plants, however, it seems likely that immunization may be artificially applied, if indeed it has not already been developed empirically in some instances. Attention may be called in this connection to the regular presence of certain viruses in all standard varieties of American potatoes, without any symptoms whatever being exhibited under any known environmental conditions. This situation has been rather obscurely explained by reference to examples of "symptomless carriers," of which, to be sure, this is one of the best examples among plant viruses. Those who would place such apparently healthy potatoes among examples of "masked carriers" are even more obviously begging the question[6]. In the light of the present conception of acquired immunity in plants, is it not more likely that the potato mottle and potato ring-spot viruses, which appear to have established a permanent association with the vegetatively propagated potato, are able to do so without producing symptoms by virtue of an acquired immunity on the part of the potato? This theory is supported in part by the observations of both Botjes[1] and Salaman[7] and others, who have noted the protective action of a mild strain of a potato virus (probably the "mottle" virus) against a more severe strain. Such protective inoculation by the potato

mottle virus has been further corroborated by the writer against the potato ring-spot virus, a closely related form (Fig. 6).

SUMMARY

Tobacco plants naturally affected in the field with tobacco streak, a virus disease characterized by necrosis in or along the veins of the leaves, regularly show "recovery" from the necrotic symptoms.

Approximately 800 tobacco plants, artificially inoculated under greenhouse conditions, have all shown a similar characteristic of early "recovery" from the first attack of the typical disease. One hundred and thirty recovered plants of various sizes, ages, and degrees of vigor, when reinoculated with the streak virus, have in all cases failed to succumb to a second attack of the necrotic form of the disease. Of the same number of adequate controls, 115 yielded typical streak. Certain other species of Nicotiana behave in a similar manner.

Six other viruses failed to yield any significant protection against streak. Conversely, the streak virus failed to protect the host against the other viruses tested.

It is believed that recovery from the tobacco streak disease is a good example of acquired immunity, and that, in the case of some vegetatively propagated host plants, artificial immunization against certain virus diseases may become a practical control measure.

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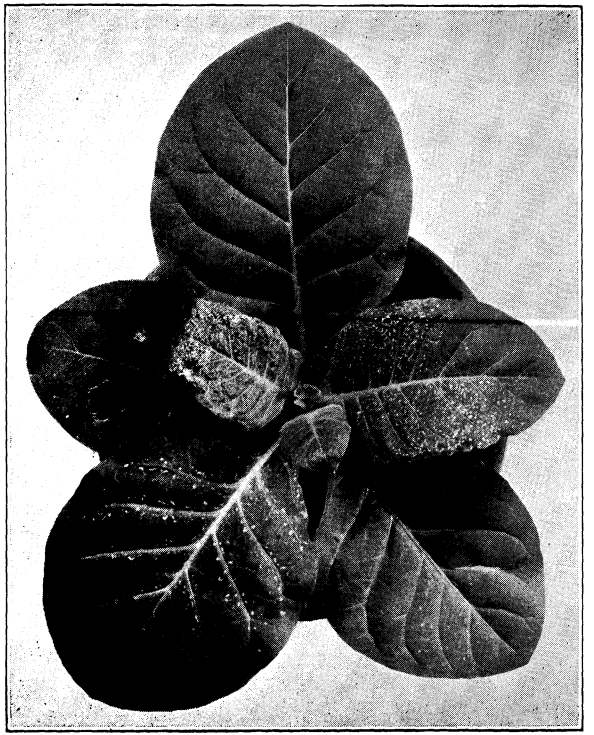

Fig. 1. Typical symptoms of tobacco streak on a young plant of *N. tabacum* about six days after inoculation and just prior to start of recovery.

Fig. 2. An early stage of recovery from tobacco streak.

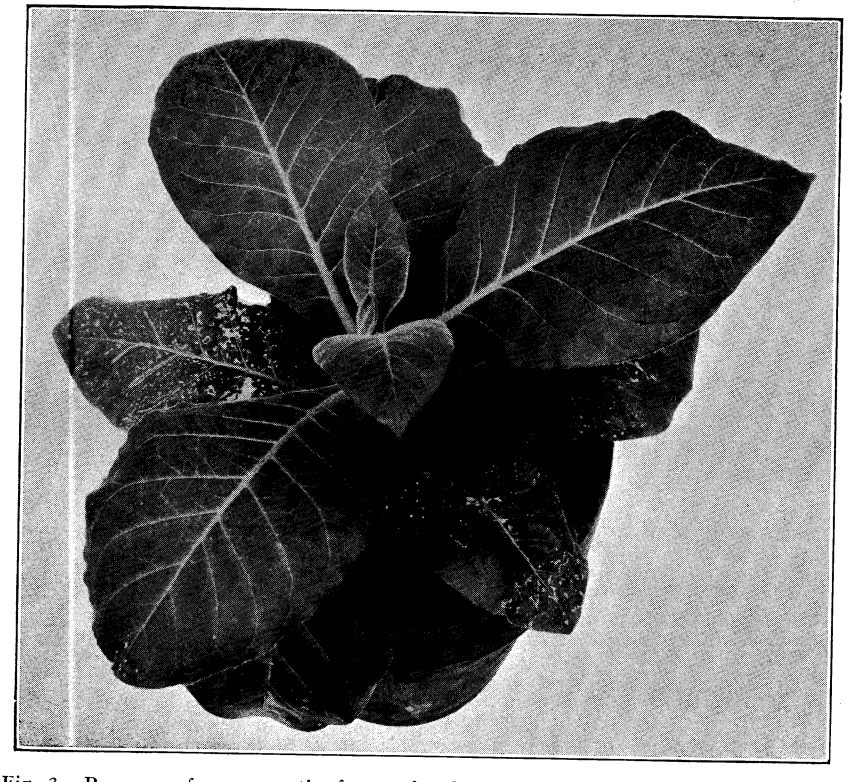

Fig. 3. Recovery from necrotic form of tobacco streak distinct, but some vein clearing and mild mottling evident on recovered leaves.

Fig. 4. An older plant inoculated when young, showing lower leaf with signs of primary infection, with two leaves immediately above necrotic and dwarfed followed by upper leaves entirely free from necrotic symptoms.

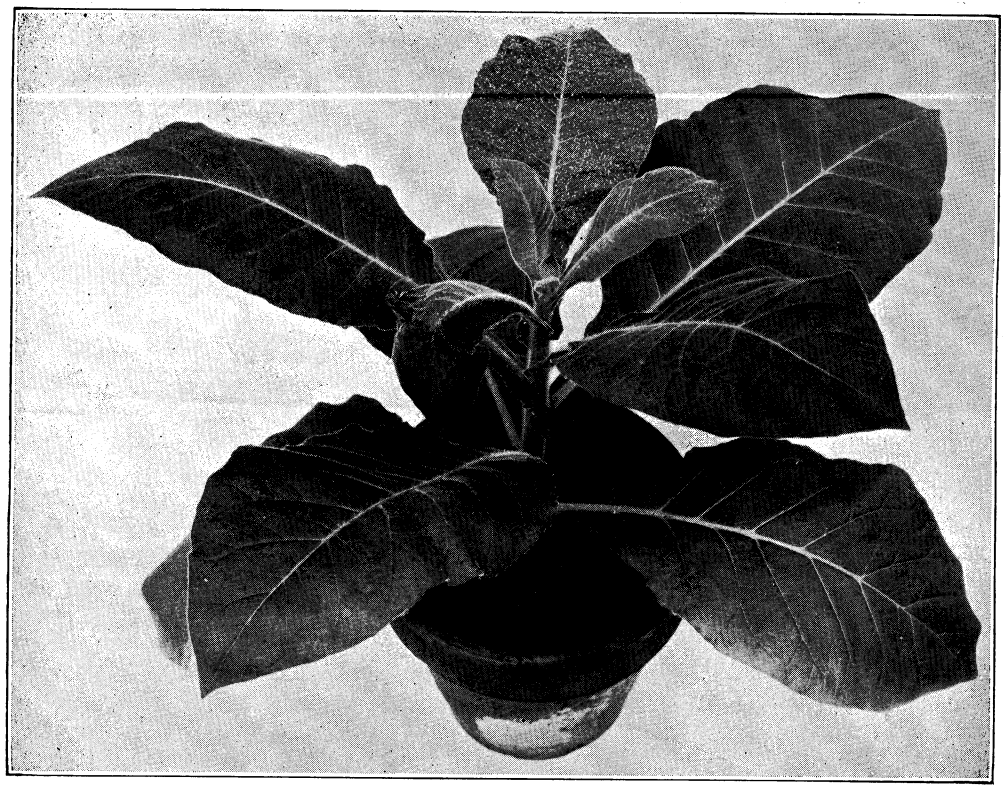

Fig. 5. An older plant, inoculated late in growth showing susceptibility to necrosis, as compared to similar leaves in plants previously inoculated as in Figure 4.

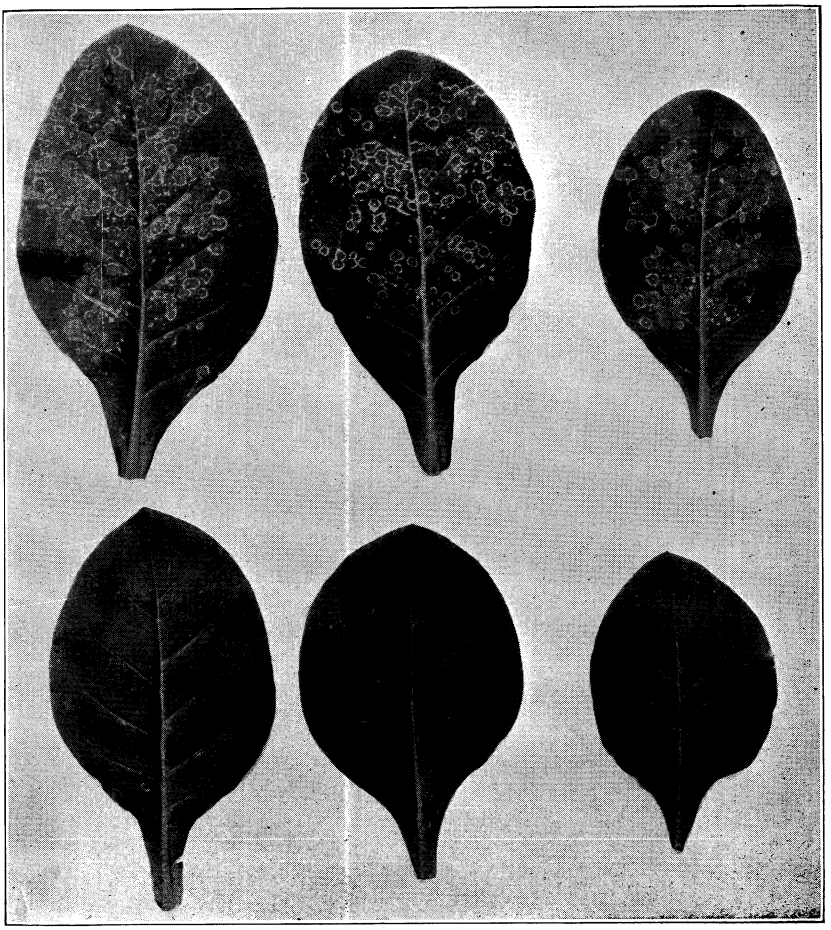

Fig. 6. Lower 3 leaves inoculated with potato "mottle" virus, followed 5 days later by inoculation with potato "ring-spot" virus. Compare with 3 control leaves above inoculated with ring-spot at same time.

FOSSIL EVIDENCE OF TWO PRAIRIE INVASIONS OF WISCONSIN

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A study of the fossil pollen content of the Gibraltar bog in Columbia county, Wisconsin, indicates that the post-glacial forest succession of the region has been twice interrupted by prairie conditions. This bog lies at the foot of Gibraltar Bluff, about three miles northwest of Lodi, Wisconsin. It is seven miles within the western limit of advance of the Green Bay lobe of the Wisconsin Glaciation (Alden '18) in the region mapped by Alden as ground moraine, but which in the vicinity of the bog is perhaps more aptly described by the term "pitted outwash". The peat deposit, which was found by a series of borings to be about seven meters thick at its deepest point, rests upon gray clay of glacial origin over bed rock described by Alden as "light colored friable sandstone." The saturation of the peat is maintained by a small stream of water flowing into the bog at the east end. There is no visible outlet. The land to the west and south of the bog is under cultivation; that to the east is pasture, and on the north rises the bluff, the slopes and top of which are wooded. Oak is the most prominent feature of the forest flora. Elm, ironwood, poplar, basswood, hickory, red cedar and white pine are also present. The vegetation of the bog proper is chiefly *Sphagnum,* leatherleaf, cotton grass and bog birch. There is a peripheral band of sedges containing some patches of cattails, and a surrounding moat which in normal years is filled by water but which, at the time this study was made, was free from standing water except for an occasional pool. The vegetation of the moat consisted chiefly of grasses, sedges, *Sagittaria* and *Bidens* spp. *Sparganium androcladum* (Engelm.) Morong. is present in one of the pools. The bog is devoid of tree growth except for a small dead tree, apparently *Larix.* Bark and twigs of what appears to be *Betula* spp. (not *B. pumila* var. *glandulifera*) have been excavated from a depth of 40 inches in the vicinity of the dead tree. No other evidences of forest peat have been found. The relatively few species represented in the edaphic

flora and the absence of forest interruption of the bog succession, together with its considerable depth, make this deposit an especially suitable subject for the investigation that has been conducted.

Methods

Pollen counts were made from a column of peat taken from the center of the bog at a point where it was 6⅛ meters deep. The peat was removed by means of a Davis peat sampler and its subsequent treatment was similar, with slight modifications, to the methods described by Erdtman ('31). Counts were made at quarter meter intervals, each count consisting of a minimum of 200 pollen grains. Opinions vary as to the number of grains constituting a reliable count (Bowman '31, Sears '31). In the present instance, in a series of 86 species counts, it was found that in 51% of the cases the counts were stabilized to within 1% at the end of the first hundred; 80% were stabilized to within 1% at the end of the second hundred; 93% to within 1% at the end of the third hundred; and 94% to within 1% at the end of the fourth hundred. 56% of the species counts reached complete stability at the end of the third hundred. Stability is defined as the point at which counting an additional hundred does not affect the percentage of the total to the extent of 1. On the basis of this evidence, 200 pollens in each level were taken as a reliable count except in instances where wide discrepancies between the first and second hundreds occurred in the percentages of significant pollens. In those cases a third hundred was counted.

Results

A series of borings was made to ascertain the stratigraphic features of the bog. The lower levels of peat were found to be limnic in origin. In the center of the bog this peat consisted of a quarter meter of gray ooze, which was topped by a two meter thick layer of the remains of water mosses including species of *Drepanocladus* (identified by Mr. L. S. Cheney). Toward the eastern end of the bog the limnic peat consisted of 1.5 meters of *Potamogeton* remains among which was identified *Potamogeton Robbinsii* Oakes. In the center of the bog the limnic peat was covered by two layers of raw *Sphagnum* peat separated by a

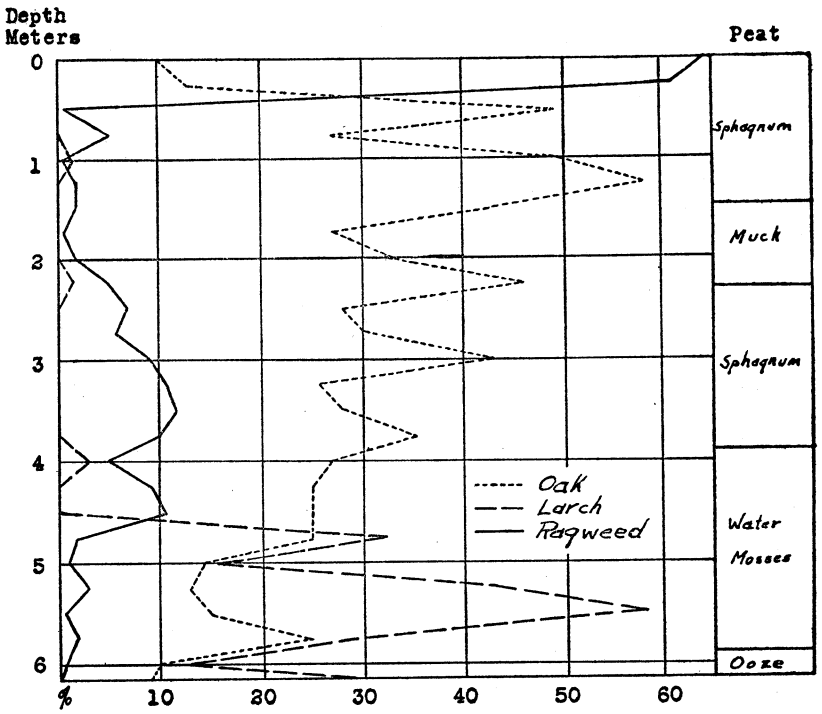

Fig. 1. Pollen frequency curves of the three major dominants, oak, larch and ragweed. The nature of the peat is shown in the column on the right.

layer of black, highly oxidized peat, or muck, (Fig. 1). Nearer the eastern shore the *Sphagnum* peat was found to be interrupted by two layers of muck, the second, or higher layer, showing a greater degree of disintegration than the first.

The percentages of pollen occurring at each quarter meter level are given in Table I. Where it has been possible to do so, identification of the species has been made; otherwise identification has been carried only to the genus or family. In analyzing the data presented by the pollen counts, the writer believes that it is necessary to separate the pollens into two groups: the edaphic pollens, or pollens of those plants that have contributed directly to the formation of the peat; and the exotic pollens, or pollens of those anemophilous species growing in the surrounding region. The frequency of each species is then computed in terms of the percentage of its own group. This step is justified by the fact that fluctuations in the frequencies of edaphic and

exotic species may be due to totally unrelated causes, and occasional high percentages of certain edaphic species so distort the frequencies of the exotic pollens as to obscure their relationship to each other and to their own frequencies at different levels. Table II contains the pollen frequencies of the significant groups computed as described above.

Figure 1 presents graphically the frequencies of the three major dominant pollens. The position of larch in this group may be questioned because of its high selectivity in habitat. As this pollen, however, reaches its maximum frequency during the lake period of the bog, it cannot justly be included among the edaphic species, but its presence is an indication of the prevalence of peat soil in the surrounding area during the early stages of development of the bog. With the rapid diminution of larch pollens to zero, oak becomes the major dominant pollen in the peat until the 0.25 meter level where it is abruptly replaced by ragweed pollen which maintains its dominance in the surface level.

As shown in Figure 2, the dominance of oak pollen in the peat is interrupted at two points by grass and at one point by maple. The earlier of the grass interruptions, at the 2.5 meter level, is associated with a marked decrease in oak, but with slight diminution in the frequency of conifer pollen, which is represented at this level by only pine (Table II). The second interruption, at the 1.75 meter level, is correlated not only with a sharp decrease in oak pollen, but also with the almost complete disappearance of conifer pollen. It is of interest also to note here the high frequency of grass pollen in the very earliest stage of development of the bog, where it is exceeded only by larch. The maple maximum in the 0.75 meter level does not involve in any degree an interruption of the forest succession, but does indicate its trend during the period represented by that level.

Conclusions

Stratigraphic study indicates that Gibraltar bog was initiated in a small lake immediately upon recession of the third substage of Wisconsin glaciation, and that it contains an essentially unbroken record, in the form of plant remains and pollen deposits, of that portion of the flora which has contributed directly to the building up of the peat and also those anemophilous

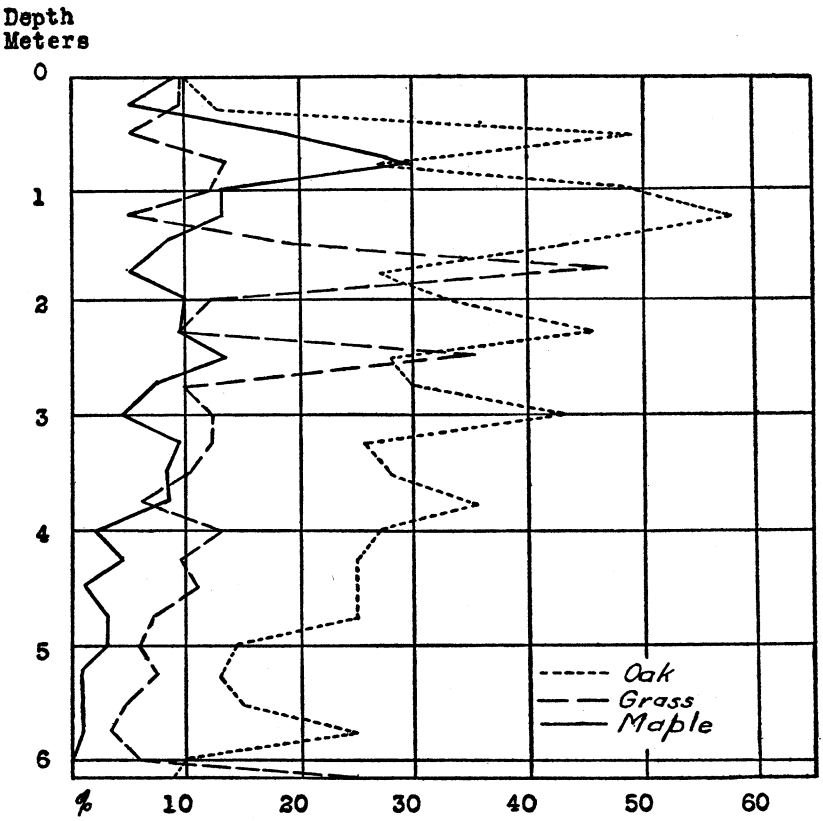

Fig. 2. Pollen frequency curves of oak, grass and maple.

species which have entered into the composition of the surrounding vegetation. Pollen analysis of the peat indicates that coniferous forests were established in the region immediately upon the initiation of the bog and remained as the prevailing forest flora during its early development. The high frequency and subsequent disappearance of larch during this period of development may, because of its high selectivity in habitat, be due to edaphic causes having little or no correlation with climatic conditions.

The second stage in the forest succession involves the disappearance of larch and the assumption of dominance by oak. The period of oak dominance is interrupted at two points by grass. The nature of these two interruptions differs in that the first is associated with a considerable amount of pine, whereas the sec-

ond, which is much more marked than the first, involves not only a sharp decrease in oak but also the almost complete loss of pine, and is correlated with a layer of highly oxidized peat. Although Voss ('34) in several analyses limited to the pollens of forest species finds no evidence of climatic fluctuations, the writer believes that these two grass interruptions of the forest succession can be explained only by environmental changes of a general nature, presumably climatic. Assuming the validity of the climatic significance of fossil pollens suggested by Sears ('31), the first interval of grass dominance would, because of its association with pine, represent a cool dry period of postglacial time, while the second interval would represent a warm dry period of sufficient intensity to bring about the severe degeneration of the surface of the bog which is evidenced by the layer of muck formed at that time. The amelioration of this dry period is indicated by the increase in maple in the succeeding levels of the peat.

The marked increase in the frequency of ragweed indicated in the two upper levels of peat is undoubtedly correlated with the clearing and cultivation of the adjacent land.

ACKNOWLEDGMENTS

An expression of appreciation is due to Dr. N. C. Fassett for his encouragement and efforts in behalf of this investigation; to Dr. P. B. Sears for his interest and helpful suggestions; and to Dr. L. R. Wilson and other fellow students who have so kindly lent their assistance in the accomplishment of the field work.

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TABLE I. PERCENTAGES* OF POLLENS AT QUARTER-METER INTERVALS

Depth, meters	0	¼	½	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6	6⅛
Abies																	1					5			1	4
Acer spp.	5	4	15	12	9	8	5	2	4	3	4	4	1	4	3	4	1	3		1	2	1	1	1	1	
Acer spicatum		1		2		1	1	1	1	1	2	1	2	1	3	3										
Alisma				1			1			1			1													
Alnus	1	1		1	1	1	1		3	5		1	2	1	1	1	2		2	3	1	1		2	2	10
Amaranthus	1		1						1	1		1							1		1	1	1		1	
Ambrosia	47	48	1	3	1	2	1	1	1	2	3	4	7	6	10	8	3	7	9	2	1	3	1	2	1	
Artemisia	1		1	1		1												1	4		1					
Betulaceae spp.	1	1	4	2	1	2	2	1	2			1	2	1		6	1	7	5	2	3	2	4	3	25	1
Betula pumila		1	1	1	1	6	1	2		1				1		1		1	2	1	2	1		2	5	
Carya		1	5	1	1	2	1	1	1	1			2	1	1	3	1	5	1	1	3	1	1	1		
Ceratophyllum																		1							1	
Chamaedaphne	1	2	5	7	1	1		1			3	2	1	4	7	1			1		1					
Chenopodium	1	1	1	1	1		1	2	1				1	1	1	1	2	3	1	1	1	2		1		1
Compositae spp.			1		1	1	1	4	2	1	1	6	2	5	9	2	1	1	1	1	1	1		1	1	2
Cyperaceae	11	11	5	6	8	10	6	1	13	2	10	6	7	6	4	2	6	4	12	2	2	1	1	2	1	3
Fraxinus		1	1	1			1	1	2				1		1	1	3	1		1	1					
Gramineae	7	8	4	6	8	3	12	26	6	3	15	7	9	6	8	5	8	8	9	6	4	8	4	3	5	20
Juglans			1	1			1	1		1			1	1	3	2	1	2		2				1		
Larix					1					1			1				2			27	13	38	52	27	12	24
Ledum		1	1	1										1							2					
Picea spp.									3			3								1	1			1	2	
P. canadensis																	1	1	1	1	4	2	1	1	1	3
P. mariana																			1							1
Pinus spp.																			2	2	1	5	1	1	1	8	1
P. Banksiana			1		1	1			1	1		2	2	2	2	1	1	2	2	1	1	1	1	1	1	
P. resinosa		2	1	4			5				4	1	3	3	2			2	2	1	1	1	1	1	1	
P. Strobus	1	1	6	1	7	2	4	1	2	3	3	9	8	3	7	7	12	9	12	4	8	8	3	3	5	
Plantago	1																									
Populus	1				2	2		1	1			1	1	1				1		1	1	1	1	1	1	
Potamogeton																					2		1		3	2
Quercus	7	11	42	14	32	36	26	15	17	15	12	19	30	14	23	29	17	20	20	20	11	12	14	23	9	7
Rumex																			2				1			
Salix	1	2	1	1	1	1		2	3	1	1	4			1	2	4	1	1	2	5	5	2	6	8	9
Sparganium			1	1	1								1												1	2
Sphagnum	11	2	2	32	2	14	30	1	25	60	40	20	13	32	6	14	1			1	1	1		1		
Tilia		1		1			1									1		1		1	1	1	1	1	1	
Typha											1	2		1												
Ulmus	1	1	2	1	2	4	1	2	1	3		5	1	6	9	9	3	11	8	8	15	3	5	14	8	2
Unidentified	6	2	3	6	29	9	5	33	8	3	5	6	10	5	2	4	33	14	9	11	17	10	10	10	8	12

* Fractional percentages stated in terms of the nearest integer.

TABLE II. PERCENTAGES* OF EXOTIC POLLENS

Depth M	Fir	Larch	Spruce	Pine	Maple	Oak	Ragweed	Grass	Others
0				1	7	10	64	10	8
¼				3	5	13	61	10	8
½			1	9	18	49	1	5	17
¾				9	29	27	5	13	7
1		2		12	13	49	1	12	11
1¼				3	13	58	2	5	19
1½				14	8	43	2	19	14
1¾				2	5	27	1	47	18
2			6	12	10	33	2	12	25
2¼		2		11	9	46	5	9	18
2½				14	13	28	7	35	3
2¾			4	17	7	30	6	10	26
3		1		17	4	43	9	12	14
3¼				13	9	26	11	12	29
3½				13	8	28	12	10	29
3¾			1	9	8	36	10	6	30
4	2	3	2	21	2	27	5	13	25
4¼			1	16	4	25	9	9	36
4½			1	21	1	25	11	11	30
4¾		32	1	7	3	25	2	7	23
5		16	8	17	3	14	1	6	35
5¼	1	43	2	12	1	13	3	9	16
5½		58	1	5	1	15	1	4	15
5¾		30	2	12	1	25	2	3	25
6	1	13	2	15	1	10	1	6	51
6⅛	5	29	4	1		9		24	28

* Fractional percentages stated in terms of the nearest integer.

COMBINED NITROGEN AND THE NITROGEN FIXATION PROCESS IN LEGUMINOUS PLANTS*

P. W. WILSON AND F. C. WAGNER

For more than fifty years the fact of fixation of elemental nitrogen by biological agents has been established, but knowledge of the mechanism of the process is still quite meagre. In contrast to the high temperatures and pressures required for the industrial processes, biochemical fixation of nitrogen occurs in the living cell under ordinary temperature and pressure conditions. Knowledge of how fixation is accomplished in nature probably would have definite practical application in addition to its theoretical importance to biological science. Although attempts to reach an understanding of the mechanism have met with little success, research involved has revealed a number of the chemical factors concerned in the process. One of the most interesting of these is the so-called "combined nitrogen effect."

If an inorganic source of nitrogen (ammonium salts, nitrates) is supplied a leguminous plant inoculated with the proper species of bacteria, invasion of the plant, *i.e.*, formation and development of nodules, and fixation of free nitrogen are greatly inhibited. Of the hypotheses[2] which seek to explain this apparent ability of a plant to control the fixation process according to its needs for nitrogen, the one based on supply of carbohydrate appears to be best supported by experimental data.

In contrast to the effects of combined nitrogen usually observed, occasional reports[1] claim that small quantities of combined nitrogen exert a beneficial effect on nodule formation and fixation of free nitrogen by inoculated leguminous plants. Suggestion has been made that the origin of this apparent contradiction of effects lies in the stimulative action of small quantities of combined nitrogen on the development of the plant. Experiments to be discussed in this paper indicate that the observations can be explained by an extension of the carbohydrate

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* Herman Frasch Foundation in Agricultural Chemistry, Paper No. 94. Contribution from the Departments of Agricultural Bacteriology and Agricultural Chemistry, University of Wisconsin. Manuscript received June 10, 1935.

supply hypothesis, and thus a common basis is provided for interpretation of apparently discordant data.

Experimental

Suggestion of the carbohydrate hypothesis was first obtained from experiments in which inoculated clover plants were supplied additional CO_2 [5]. In this work if the pCO_2 of the atmosphere exceeded 0.5 per cent, frequently the onset of nitrogen fixation was delayed and the period of "nitrogen hunger" prolonged. Plants in this stage had yellow leaves, red stems and were quite stocky. Examinations of roots of these plants showed numerous small, round, scattered nodules. Plants of the same age supplied with air (0.03 per cent CO_2) were green, thrifty with few well-developed nodules. As soon as nitrogen fixation started in the plants given additional CO_2 development was very rapid and eventually the plants exceeded those grown in air with respect to both size and nitrogen fixed.

Inoculated Manchu soybeans grown outside under intense sunlight and long days responded in a manner similar to clover plants given additional CO_2. Nitrogen fixation was delayed and the plants remained small, yellow and woody; uninoculated plants given *combined nitrogen* were large, green and thrifty. Shading plants of the inoculated series for one week resulted in the onset of nitrogen fixation accompanied by rapid development of the plants[3].

An interpretation of these observations was that under certain environmental conditions (high CO_2, high light intensity, low combined nitrogen in substrata) an excessive carbohydrate-nitrogen balance obtained in the plants. This excessive balance restricted development of nodules and fixation of nitrogen. Any factor which narrowed the carbohydrate-nitrogen relation, *e.g.*, shading, stimulated increase of nodules and fixation of free nitrogen.

Tests of this hypothesis were made by study of nitrogen fixation and nodule development by clover plants in which the carbohydrate-nitrogen balance was varied. Ten clover plants were grown in 64 oz. glass bottles supplied with an atmosphere in which the pCO_2 had been increased to 0.5 per cent. A nitrogen-poor sand plus nitrogen-free Crone's solution was used as a substrate. Inoculation with *Rh. trifolii* was delayed until plants

given no combined nitrogen exhibited signs of marked carbohydrate excess. Variation of the carbohydrate-nitrogen balance was accomplished by supplying certain bottles in each experiment with NH_4 NO_3 at different stages of development. At harvests observations were made on number, size and distribution of nodules and determinations made of dry weight and total nitrogen. The details of the treatment used in a given experiment will be apparent from the tables. In experiments III and IV, one-half gallon stone jars were used as containers. In all experiments made between Oct. 1 and Apr. 15 artificial illumination was used to supplement natural light[4]. Observations of the nodules are detailed in the following:

EXPERIMENT I

No nitrogen added—nodules small and scattered.

3 mgm. N at planting—nodules large and clumped; often 10 to 20 in one clump.

EXPERIMENT II

No N added—large number of small white nodules scattered over secondary roots.

3 mgm. N at planting—large number of large well developed nodules.

3 mgm. N at inoculation—fewer nodules than in other series; large and well developed.

This experiment was made during extreme waves of heat and the plants did not develop well.

EXPERIMENT III

No N added—few scattered, small nodules.

5 mgm. N at planting—numerous, medium size nodules.

5 mgm. N at inoculation—numerous, medium size nodules.

This experiment ran concurrently with experiment II, but the plants were grown in open one-half gallon pots; the development of the plants was much better in these containers.

The results of these three experiments are summarized in table I. In tables II, III and IV are summarized the essential data from experiments IV to VI including observations of nodules.

DISCUSSION OF DATA

Consideration of the data in the tables and text indicates that the outstanding effect of combined nitrogen on inoculated plants

high in carbohydrate is to increase the size of nodules formed. In general, nodules on plants with an excessive carbohydrate-nitrogen balance (as indicated by low percentage of nitrogen) were small, round and white; those on plants with a more narrow carbohydrate-nitrogen relation were medium to large in size, oval and pink. The former type of nodule is characteristic of those produced by inefficient strains of the organisms, whereas, the latter is typical of efficient strains. It is of interest that nodule production was made to vary by changing the carbohydrate-nitrogen relation of the plant in a manner analogous to that resulting from use of strains of bacteria of different efficiencies[1].

Number of nodules usually was greatest on plants with the widest carbohydrate-nitrogen relation, *i.e.*, lowest percentage of nitrogen. In some experiments this did not hold, but the discrepancy arose from large differences in the size of the plants. Plants given combined nitrogen at time of seeding were large and hence would tend to have more nodules—independent of the carbohydrate-nitrogen balance. In order to compensate for differences in size, number of nodules per unit weight of plant was calculated. On this basis, in all experiments except III, the number of nodules on plants decreased with the quantity of combined nitrogen added.

In order to eliminate large differences in development of the plants under comparison, combined nitrogen was added to certain series of plants at the time of, or immediately before, inoculation. The method was found to be quite effective in changing the carbohydrate-nitrogen relation in the plants without marked increase in the size. The effects of combined nitrogen on number and development of nodules were practically the same as those noted when the NH_4NO_3 was added at time of planting. This result indicates clearly that the beneficial effects of supplying plants with small quantities of combined nitrogen arises not merely because of increased development of the plant, but also from change of unfavorable carbohydrate-nitrogen balance in the plant.

Data of experiment IV (table II) offer striking evidence of the manner in which the relative quantities of carbohydrate and nitrogen in clover plants affect nodule formation and development. Nodules were small on plants given no combined nitro-

gen, much larger on plants given 1 to 3 milligrams NH_4NO_3-N per bottle, but very small on plants given 5 milligrams of nitrogen. In all cases, *number* of nodules was inversely proportional to quantity of nitrogen available. Similar data are supplied by experiment VI, especially in the first harvest.

In clover plants with an extremely wide carbohydrate-nitrogen relation, not only is the development of nodules restricted, but likewise fixation of atmospheric nitrogen is delayed. Data summarized in table III indicate that plants with the higher percentages of nitrogen at time of first harvest initiated the fixation of free nitrogen earlier and developed more rapidly (dry weight) than did those with a wider carbohydrate-nitrogen balance.

The acceleration in development of the plants given NH_4NO_3-N which initially depended on a source of readily available nitrogen is maintained because of the increased rate of free nitrogen fixation by these plants. Since the experiments were relatively short, the differences in quantity of nitrogen fixed were not marked because the combined nitrogen added was still an appreciable part of the total in the plant. With increasing age, the differences would likely become more pronounced since the development of plants is exponential in character and any initial difference tends to become greater in absolute value with time.

Summary and Conclusions

The data of these experiments suggest that a unified hypothesis based on chemical composition of the plant may be offered in explanation of the effects of combined nitrogen on nodule development and fixation of free nitrogen by inoculated leguminous plants. Briefly, this hypothesis is: *the response of the symbiotic system of an inoculated leguminous plant to combined nitrogen will depend on how the latter alters the carbohydrate-nitrogen relation of the plant.* In a plant high in carbohydrate, addition of a small quantity of combined nitrogen will favor development of nodules and fixation of free nitrogen; but with large quantities, the reverse obtains. The significance of these observations with reference to the more general problem of the biochemistry of the fixation process is discussed in an-

other paper[6]; certain practical applications will be briefly indicated in this report.

On fields that are low in combined nitrogen planted with small-seeded leguminous crops, it is possible that a disastrous delay in the onset of nitrogen fixation may occur because of an excessive carbohydrate-nitrogen balance in the plant. The slow development of plants with excessive carbohydrate may be sufficient to cause crop failure especially under unfavorable conditions, *e.g.*, hot, dry weather. In such cases, additions of small quantities of combined nitrogen should prove economical, since an impetus to the initial growth of the plant may result in development sufficient for overcoming adverse environmental conditions. Likewise, higher yields of crops will be favored if the fixation process is not delayed.

In testing bacterial cultures for artificial inoculation of clover, alfalfa and other small-seeded leguminous plants, the results may be vitiated under certain conditions because of an extremely wide carbohydrate-nitrogen balance in the plants. If the plants in such tests are supplied with small quantities of combined nitrogen, a better evaluation of the cultures might be obtained. Also, it is possible that the time required for the testing would be lessened because of the stimulation of the early development of the plant.

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TABLE I

Effect of combined nitrogen on nodule formation and nitrogen fixation by inoculated clover plants high in carbohydrate

Treatment	Dry Wt.*	Nitrogen			Nodules	
		Total	N. Fixed	% N.	Total	Per unit weight
	mgm.	mgm.	mgm.			
Expt. I.						
No. added N	225	6.84	4.34	2.93	167.2	743
3 mgm. N when planted	580	14.4	9.9	2.49	275.0	474
Expt. II						
No added N	76	1.4	0.0	1.84	36.6	481
3 mgm. N when planted	255	6.0	1.5	2.35	127.6	500
3 mgm. N when inoculated	113	3.2	....	2.85	31.7	280
Expt. III.						
No added N	252	4.42	1.08	1.75	84.6	335
5 mgm. N when planted	314	5.69	.....	1.81	151.0	480
5 mgm. N when inoculated	390	9.49	1.15	2.41	156.3	400

	Planted	Inoculated	Harvested
Expt. I	4—19—34	5—21—34	6—26—34
Expt. II	7— 5—34	8— 7—34	8—27—34
Expt. III	7— 5—34	8— 7—34	8—28—34

* All data in tables, unless otherwise noted, on 10 plant basis.

TABLE II

Dry weight and nodule formation by inoculated clover plants supplied combined nitrogen. (Expt. IV.)

Treatment	Dry wt. of plants	Nodules		
		Total	per unit wt.	Observations
	mgm.			
None	250	108	428	M Sc R
1 mgm. N at time of inoculation	336	87	258	L C O P
2 mgm N at time of inoculation	398	83	210	L Sc O-R W-P
5 mgm. N at time of inoculation	413	37	89	S Sc R W
1 mgm. N 5 da before inoculation	405	127	313	L C O
2 mgm. N 5 da before inoculation	440	104	236	L C O
5 mgm. N 5 da before inoculation	333	15	44	S Sc R W
3 mgm. N 2 wks. after planting	550	95	173	M Sc O
3 mgm. N 3 wks. after planting	405	52	128	M Sc R-O

S—Small
Sc—scattered
W—white
R—round
B—brown

L—large
C—clumped
P—pink
O—oval
M—medium

Planted —11— 1—34
Inoculated —12— 5—34
Harvested —12—27—34

TABLE III.

Dry weight and nitrogen content of inoculated clover plants given combined nitrogen

Treatment	At Inoculation			Harvest 1			Harvest 2		
	Dry wt.	Total N	% N	Dry wt.	Total N	N fixed	Dry wt.	Total N	N fixed
Experiment V	mgm.	mgm.		mgm	mgm.	mgm.	mgm.	mgm.	mgm.
None	150	1.6	1.10	180	2.0	..,.*	160	2.3	0.1
1 mgm. at inoculation	150	1.6	1.10	180	3.3	0.1	200	3.6	0.4
3 mgm. at inoculation	150	1.6	1.10	180	4.5	.....	235	5.8	0.6
2 mgm. 3 da. before inoc.	170	2.6	1.53	160	4.1	.....	240	5.1	0.9
Experiment VI									
None	96	1.27	1.32	136	.....	.,....	250	6.97	5.69
2 mgm. at inoculation	96	1.27	1.32	160	4.64	1.37	370	9.95	6.68
5 mgm. at inoculation	96	1.27	1.32	131	5.00	.....	450	12.5	6.23
2 mgm. 5 days before inoculation	91	2.26	2.48	148	3.95	0.68	353	10.2	6.93
5 mgm. 5 days before inoculation	117	3.14	2.68	165	5.22	.....	470	12.4	6.13
2 mgm. 2 weeks after planting	137	3.27	2.39	212	4.64	1.37	420	10.6	7.33
5 mgm. 2 weeks after planting	167	5.06	3.03	298	8.30	2.03	625	16.3	10.03

* Blanks indicate no nitrogen was fixed; total nitrogen does not exceed N added plus nitrogen in plants to which no nitrogen was added at time of inoculation.

TABLE *IV*

Correlation between per cent nitrogen and nodule production by inoculated clover plants

Treatment	Harvest 1				Harvest 2			
		Nodules				Nodules		
	% N	Total	per unit wt.	Observations	% N	Total	per unit wt.	Observations
Experiment V								
None	1.10	63	350	S R W	1.46	121	756	M O-R C
1 mgm. at inoculation	1.84	38	211	S R W	1.82	125	625	L O Sc
3 mgm. at inoculation	2.50	31	172	R M W Sc	2.48	80	340	L O Sc
2 mgm. 3 da. before inoc.	2.55	15	93	S R W	2.13	115	479	L B C
Experiment VI								
None	.....	54	397	S R Sc	2.79	100	400	M Sc
2 mgm. at inoculation	2.89	28	175	M-L O Sc	2.69	85	230	M-L O Sc
5 mgm. at inoculation	3.81	6	45	M O	2.78	85	189	M O B
2 mgm. 5 days before inoc.	2.57	49	331	S W O Sc	2.90	107	303	M-L Sc
5 mgm. 5 days before inoc.	3.16	17	103	M W R	2.64	123	262	M O-R
2 mgm. 2 weeks after planting	2.19	117	551	M O Sc W	2.53	182	433	M-L O
5 mgm. 2 weeks after planting	2.79	97	325	M-L O P	2.59	186	297	M-L O B

	Planted	Inoculated	Harvest 1	Harvest 2
Experiment V	9—14—34	10—17—34	10—24—34	10—31—34
Experiment VI	1—19—35	2—22—35	3— 2—35	3—16—35

CONDUCTIMETRIC TITRATION OF ORGANIC BASES IN GLACIAL ACETIC ACID

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It has been shown in a series of papers on highly acid solutions,[1] that certain organic bases dissolved in glacial acetic acid can be titrated potentiometrically with certain strong acids such as perchloric acid and sulfuric acid also dissolved in glacial acetic acid. The shape of the titration curves obtained in this way is dependent, among other things, upon the strength of the base titrated. By arbitrarily choosing a so-called pH^{HAc} scale[2] a pK^{HAc} for the base is calculated from the pH^{HAc} value at half-titration. In this way the pK^{HAc} value for a large number of organic bases was obtained, the numerical value of which placed the bases roughly in three classes, weak, intermediate, and strong.

It was felt that since these acid-base titrations in acetic acid gave characteristic curves when followed potentiometrically, they would likewise give characteristic curves when followed conductimetrically and that perhaps the curves might yield further information in regard to the relative strength of the organic bases. For this reason the conductimetric titration of a number of organic bases dissolved in acetic acid was undertaken.*

EXPERIMENTAL

Apparatus. A Leeds and Northrup no. 4666 Grinnell Jones Conductivity Bridge[3] was used in conjunction with a two-stage amplifier using a Hartley oscillator with a 201-A vacuum tube, operating at 1400 cycles per second, as a source of current.

The titration cell was made of a soft-glass, glass-stoppered test tube in which two bright platinum electrodes were sealed in a fixed position at the bottom. The cell constant as determined

* After the completion of this work, Kolthoff and Willman[5] published curves for the conductimetric titration in acetic acid of sodium acetate with perchloric and hydrobromic acids and also of silver perchlorate with hydrobromic acid. As would be expected, sodium acetate acted like a relatively strong base.

by comparison with a cell of known constant was approximately 0.055 at room temperature, the temperature at which the titrations were carried out.

Materials. Perchloric acid, because of its strength was used in all titrations. Anhydrous perchloric acid was prepared by distilling a mixture of 25 ml. of 60% aqueous perchloric acid and 50 ml. of 30% fuming sulfuric acid in an all glass still at about 5 mm. pressure, the receiver being surrounded by a hydrochloric acid-ice mixture and the distilling flask being heated on a water bath. The anhydrous perchloric acid was cautiously weighed from a weight pipet into glacial acetic acid and made up to a definite volume to give a stock solution of known strength.

The acetic acid used was purchased from the Niacet Chemical Company and was distilled in an all glass fractionating still. All samples used froze above 16.2°C.

The organic bases were those used in the earlier studies and were repurified by distillation, in the case of the liquids, and by recrystallization in the case of a few of the solids. In all cases the solutions were prepared by weighing out the base directly and dissolving it in a definite volume of acetic acid. Guanidine was used in the form of its acetate.

Procedure. Fifty ml. of the solution to be titrated was pipetted into the titration cell. The titrating reagent was added from a 10-ml. buret graduated in 0.05 ml. divisions. Approximately one ml. was added each time, the cell shaken well after each addition, and the resistance measured after two or three minutes. The titrations were carried out at room temperatures which ranged from 22° to 25°.

Results and Discussions

Figure 1 shows the titration curves obtained with four organic bases by adding 1.66 M $HClO_4$ in acetic acid to 50 ml. of 0.1 M base in acetic acid. Urea, the weakest base titrated, gives a curve without a break which is quite similar to the conductimetric titration curve of a weak base in the water system. The strongest base, diethyl aniline, gives some indication of strong base behavior but on the whole shapes of the curves give very little evidence of the known large differences in the strengths of the bases.

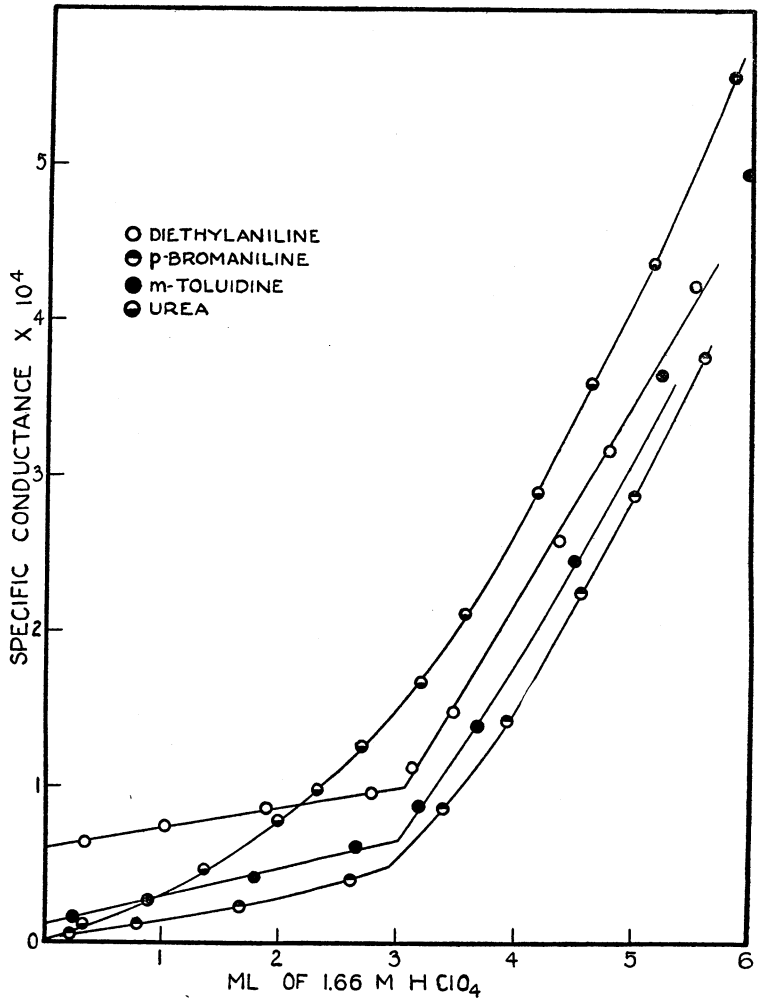

Fig. 1. Conductimetric Titration of Various Bases with Perchloric Acid

It was found that by adding the base to the acid, curves were obtained which differentiated the relative strengths of the various bases more clearly. Figure 2 shows the titration curves obtaining by titrating 50 ml. of 0.01 M $HClO_4$ with 0.1 M bases.

As can be seen, the graphs are identical in shape with those obtained by the titration of bases of various strength against a strong acid in the water system. Likewise, the slopes of those portions of the graphs to the right of the equivalence point vary

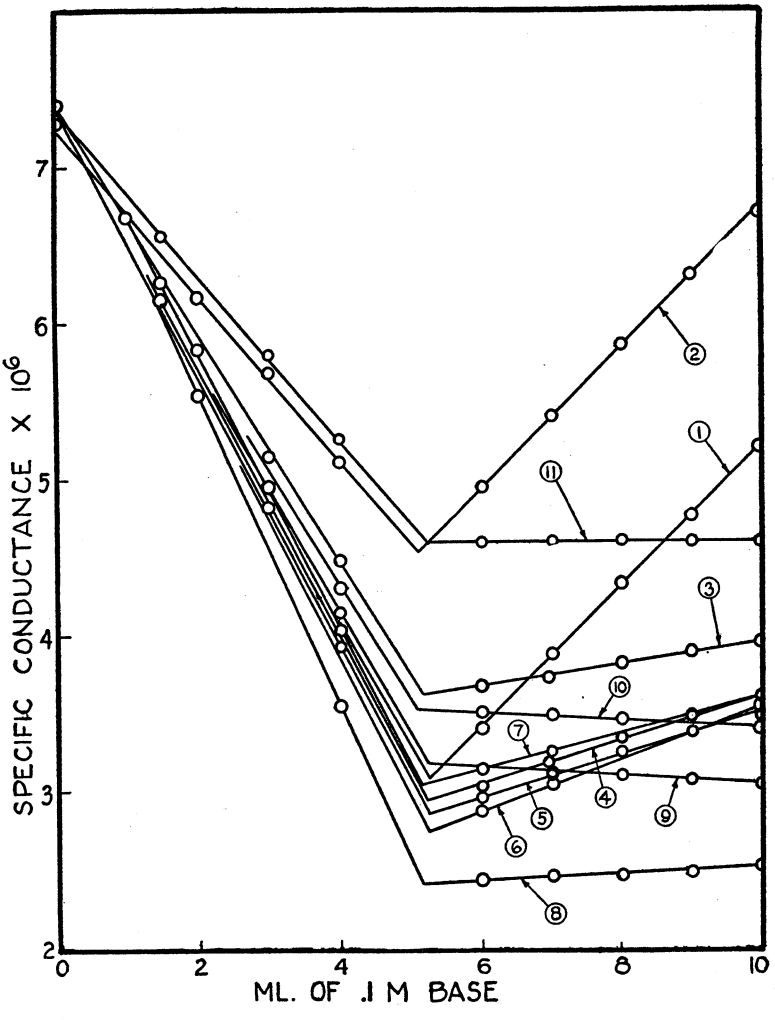

Fig. 2. Conductimetric Titration of Perchloric Acid with Various Bases

The bases used and their corresponding pK^{HAc} values are: (1) diethylaniline, 3.15; (2) guanidine, 3.10; (3) pyridine, 2.93; (4) ethylaniline, 2.83; (5) methyl p-toluidine, 2.79; (6) p-toluidine, 2.67; (7) m-toluidine, 2.57; (8) p-bromaniline, 2.20; (9) o-bromaniline, 0.90; (10) diphenylamine, —0.74; (11) urea, —0.93.

with the pK^{HAc} of the base just as the slopes of the graphs for bases in the water system vary with base strength. Thus for the strongest bases, such as guanidine and diethyl aniline, the slopes are greatest, while for such weak bases as diphenyl amine and o-bromaniline the slopes are negative. The bases of inter-

mediate strength show slopes of intermediate gradation.

The conductimetric curves do not differentiate between bases of different strength as clearly as do the curves obtained potentiometrically, and in some cases there is even a qualitative disagreement between the two sets of results. Thus, diphenyl amine ($pK^{HAc} = -0.74$) and *o*-bromaniline ($pK^{HAc} = 0.90$) differ in strength by 1.64 pK^{HAc} units yet their graphs after the equivalence point have practically the same slope. Pyridine has a curve whose slope beyond the equivalence point is less than those of a number of bases whose pK^{HAc} values are smaller. In the case of pyridine this can be accounted for by the fact that pyridine perchlorate tends to precipitate. Other similar discrepancies can be noted which give further indication[4] that as an aid to the investigation of basic strength in non-aqueous solutions, potentiometric methods have certain advantages.

SUMMARY

1. Organic bases dissolved in glacial acetic acid have been titrated conductimetrically against perchloric acid in acetic acid.

2. The shape of the graphs is similar to those of acid-base conductimetric titrations in water.

3. A comparison is made of the information furnished by potentiometric and conductimetric titrations in acetic acid.

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2. See ref. 1a, pp. 3059-3061 and ref. 1e.

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EMERGENCY VALUES OF SOME WINTER PHEASANT FOODS*

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It is fairly easy to classify winter foods for given kinds of game into two extreme groups, namely, those which are of known excellence as staples and those which are so inferior that they are hardly eaten, even when prominently available. Intermediate between the obviously good and the evidently poor food types we have a third group, the constituent items of which are not so easy to place in the nutritive scale.

Conservationists and game managers could well learn more about this third group, since its constituent foods frequently play an important part in the lives of such gallinaceous game as ring-necked pheasants and bob-whites during the periods of winter food crisis. The emergencies occasioned by snow or ice covering up or sealing most of the supply of corn or other staple foods may be of comparatively brief duration, but they may be attended, nevertheless, by heavy and sometimes wholesale mortality.

The starchy, substantial type of food apparently necessary for the wintering of pheasants and quail may be exemplified by certain cultivated grains and weed seeds: corn, sorghum, barley, wheat, rye, soy beans, pigeon grass (*Setaria*), lesser ragweed (*Ambrosia artemisiifolia*), and a relatively limited number of others that may serve as staples locally.

Foods of the questionable intermediate group have insufficient nutritive value in themselves to sustain pheasants and quail on the predominate diets of one or the other into which the birds are forced now and then by necessity. They are apt to be more varied in kinds and distribution than true staples and may be strongly represented in regular diets as well as in the diets of desperate birds having access to little else. Moreover, these less substantial foods may be abundantly present in areas virtually lacking in true staples, thus giving the conservation-minded

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public a false impression of environmental adequacy for some species it is making an effort to encourage.

The objective of this paper is to contribute information which may be helpful in the evaluation of some of the foods concerning which there has been more or less question with regards to their effectiveness as emergency diet or as winter staples.

Previous Work With Bob-white

In connection with the recent Wisconsin quail investigation, experiments were run with captive bob-whites to determine the sustentative values of certain foods eaten in quantity under emergency winter conditions (Errington, 1931).

The foods experimented with were some which field observations indicated could not sustain life during starvation crises, although they were freely eaten by famished birds. Chief among these were black locust beans (*Robinia pseudoacacia*), fruits of bittersweet (*Celastrus scandens*) and of sumac (*Rhus glabra, R. typhina*), rose hips (*Rosa*), dried wild grapes (*Vitus vulpina, V. bicolor*), and sweet clover seeds (*Melilotus*). Of the foods tested, only the beans of black locust proved to be sufficiently substantial to carry birds through winter periods of emergency.

It should be pointed out that much material not ranking as staple or effective emergency food is eaten by birds in the wild, incidentally or to provide vitamins, fruit acids, minerals, or whatever other substances may be essential to a well balanced diet—the "salad" foods of Leopold (1933). Nothing in this writing is meant to imply that foods are of no utility to a given game bird species simply because experimentation and observation indicate that the birds cannot thrive upon them as a largely exclusive diet. *They cannot be depended upon as staples,* nevertheless, and the supreme necessity of an adequate supply of staple foods for a winter-habitable environment should not be lost sight of.

Technique of Pheasant Food Experiments

The combined experimental and observational technique was of such usefulness in studying the wintering of bob-white populations (Errington, 1933) that it was next tried out on pheasants.

The experimental work was done from January to April, 1933, at Lansing, Iowa, where the discontinuation of a state game farm had made available for our purposes a stock of about 100 ring-necked pheasants. A cooperative arrangement was made with the Iowa Fish and Game Commission by which Mr. W. E. Albert, Jr. of their staff was authorized to handle and supervise the experimental routine, including the care of the birds and the collection of foods to be tested. The detailed experiments were patterned after the ones conducted with quail in Wisconsin, with modifications to meet local needs.

From 4 to 8 pheasants were used in each experimental lot and were confined in pens constructed in such a way as to give them a degree of protection from severe weather comparable to that which they would be able to get if living in the wild. Grit and water were freely available at all times and the birds were given all of the single food items that they would consume.

Care was taken to remove food remnants from pens before admitting birds to be used in particular experiments. As a final preparation for each pen, hungry "clean-up" birds were confined for several days without feeding, and it is not likely that, by the time of their removal, they missed many traces of food which we might have overlooked.

Weighings were usually made at weekly intervals for the birds on food experiments. Birds experimentally starved were, on the other hand, weighed daily to provide some sort of yardstick with which the different loss rates could be compared.

Cold doubtless did have an accelerating influence on the rates at which birds on insufficient diets lost weight, as will be taken up later in this paper.

Sex did not seem to make a great deal of difference in the ability of pheasants to withstand hunger, so no separation of data from cocks and hens will be attempted here. The role of disease in influencing experimental results obtained was on the whole probably negligible; obviously diseased birds were not selected for important experiments, and the records of those discovered to be diseased at post-mortem were carefully studied.

Check and Yellow Corn Lots

For checks, two cocks and four hens were kept on a balanced grain and green food ration an average period of 62 days

between January 20 and April 7. The cocks averaged 2 lbs. 8 oz. and the hens 1 lb. 14 oz. at the first weighing. The lot gained an average of .015 oz. per bird per day.

To test the effect of monotony of winter diet on weight retention of adult pheasants, when food of known excellence was eaten, two cocks and four hens were fed nothing but shelled corn on bare ground for periods varying from 35 to 77 days. The cocks averaged 2 lbs. 10 oz. and the hens 2 lbs. 2 oz. at the beginning of the experiment. The average gain was .033 oz. per bird per bird for an average of 61 days between January 20 and April 7.

Starvation Lots

These experiments were run to determine maximum loss rates resulting from total deprivation of food. The correlation of temperature with loss rates is especially significant.

For lot No. 1, three cocks (av. wt. before starving, 2 lbs. 11 oz.) and five hens (av. 1 lb. 15 oz.), starved for an average of 12 days at a mean air temperature of 29.2° (F.), the average daily loss per bird was 1.09 oz. The average loss per bird for the first week was 5.7 oz. or .8 oz. per day; 9.8 oz. in the next five days or 2 oz. per day.

For lot No. 2, the same number and sex of birds at the same weights, starving an average of 10 days at a mean air temperature of 1.6° (F), lost at a daily average of 1.27 oz. The average loss per bird for the first week was 8.4 oz. or 1.2 oz. per day; 10 oz. in the next 3 days or 3.3 oz. per day.

Sumac Lots

Fruits of sumac (*Rhus glabra, R. typhina*) are eaten by numerous species of birds and sometimes in large quantities during periods when food is scarce on account of heavy covering snow.

It is somewhat questionable that the correlation of loss rates with temperature is so pronounced as may appear.

For lot No. 1, one cock (2 lbs. 7 oz.) and five hens (av. 1 lb. 15 oz.) lost an average of 1 oz. per day on a straight sumac diet for an average of 13 days. The average loss for the first week was 6.5 oz. or .9 oz. per day; for the next six days, 7.4 oz. or 1.23 oz. per bird per day. The mean air temperature was 25.3° (F.).

Lot No. 2 was kept on the same sumac diet for the same length of time but at a mean temperature of 34° (F.). One cock (3 lbs. 3 oz.) and three hens (av. 1 lb. 12 oz.) lost at the average rate of .6 oz. per bird per day. The average loss for the first week was 3.8 oz. or .54 oz. per day; for the next six days, 4 oz. or .66 oz. per day.

Sweet Clover Lots

Sweet clover, often cultivated, is also widely distributed as a weed, occurring in locally heavy growths. It produces an abundance of attractive looking seeds which many people interested in game management assume to be of substantial value as game food.

The Wisconsin studies brought out the short-comings of the seed as food for quail; hence, experiments with pheasants seemed particularly in order.

Lot No. 1 consisted of three cocks (av. 1 lb. 14 oz.) and three hens (av. 1 lb. 12 oz.), kept on a straight diet of sweet clover seed for an average of 14 days. At a mean temperature of 25.6° (F.), the average loss was .66 oz. per bird per day.

The mean temperature for lot No. 2 was 31.5° (F.) and the loss rate for four hens (av. 1 lb. 14 oz.) was somewhat lower: for an average of 18 days the loss rate was .53 oz. per bird per day.

Greater Ragweed Lots

Greater ragweed or king head (*Ambrosia trifida*) is of wide distribution in the middle west and often occurs in dense stands, especially in the river bottomlands which are favored by pheasants. The sparing representation of its achenes in crops and gizzards examined gave rise to a suspicion that as food it might not be all that could be desired.

Achenes of lesser ragweed (*A. artemisiifolia*) constitute one of the most important of all quail foods in the middle west and are eaten in large quantities by pheasants as well. The achenes of greater ragweed, however, have their probably nutritious seeds encased in coats so hard and woody and so frequently armed with sharp points that they doubtless present difficulties to birds in the habit of swallowing whole the achenes of the lesser ragweed.

Lot No. 1 was fed on a straight diet of achenes dried to approximately the condition of those found during drouths; lot No. 2, on water-soaked achenes instead of dry, thus approximating the condition of those available on low grounds during ordinary winters. The extra variable introduced by moistening the achenes fed lot No. 2 makes the results of the ragweed experiments ineligible for temperature comparisons.

Lot No. 1, one cock (2 lbs. 7 oz.) and five hens (av. 2 lbs. 2 oz.) fed on dry achenes, lost an average of .65 oz. per bird per day for 19 days. The mean temperature was 17.9° (F.). Two birds died about the end of the second week, and post-mortems on these revealed severe inflammation of the alimentary tract, involving the proventriculus, gizzard, and small intestine, apparently caused by the tough, spiny achene points.

Lot No. 2, fed on water-softened achenes in warmer weather (mean temperature 33.9° (F.)), suffered no fatalities and only one bird was in very emaciated condition at the end of the experiment. One cock (3 lbs. 1 oz.) and seven hens (av. 1 lb. 13 oz.) lost at an average rate of .27 oz. per day for 14 days.

Poison Ivy and Coralberry Lots

Poison ivy (*Rhus toxicodendron*) has a more waxy fruit than that of the sumacs (*R. glabra* and *typhina*) so the possibility was considered that it might be of greater sustentative value during winter emergencies. Coralberry (*Symphoricarpos orbiculatus*) and wolf berry (*S. occidentalis*) occur abundantly in occupied pheasant range and their fruits are known to be eaten in greater or less quantities.

The fleshy consistency of both poison ivy and coralberry fruits would seem to place them in the category of "salad" foods rather than in that of winter staples, an assumption supported by the experimental evidence.

On a straight diet of poison ivy fruits one cock (3 lbs. 1 oz.) and three hens (av. 1 lb. 15 oz.) lost an average of .7 oz. per day for an average of 16 days. The mean temperature was 31.5° (F.).

The poison ivy pen was situated on a partially wooded hill side, and we strongly suspected that one bird managed to find some acorns missed by ourselves and by the pheasants used in cleaning up the pens. A similar suspicion, relative to a bird in

another experiment, which was holding its weight remarkably well compared to its fellows, proved founded when an acorn was discovered in its gizzard at post-mortem. Considerable differences in the ability of individuals to hold their weights were noted in the poison ivy experiment, perhaps due largely to the acorn variable.

The coralberry lot (four hens, averaging 1 lb. 12 oz.) lost an average of .46 oz. per bird for 17 days. Loss rates for individuals lacked uniformity for this lot also, two birds losing only 8 oz. each in three weeks. The mean temperature was 37.4° (F.).

Burdock and Velvet Leaf Lots

The seeds of burdock (*Arctium*) and velvet leaf or butter print (*Abutilon*) are of fair size, meaty, and have the appearance that one would expect of excellent game foods. Both are important weeds, growing abundantly on many farms. Although stomach data immediately at hand do not show any material representation of these foods in the diet of pheasants, it was thought well to try them out experimentally.

Three of the four hens (av. 2 lbs.) of the burdock lot lost an average of 1 oz. per day for an average of 15 days. The fourth held its weight well and was found to have been eating acorns which had escaped notice. Mean temperature: 25.3° (F.).

The average loss on velvet leaf for two cocks (av. 2 lbs. 5 oz.) and four hens (av. 2 lbs. 3 oz.) was .87 oz. per bird per day for an average of 15 days. The mean temperature was 17.9° (F.).

Dock Lot

Dock (*Rumex*) is a very common roadside and field plant and is found also in dense lowland growths. The achenes are often eaten by bird life, including pheasants, and are similar to those of buckwheat, though much smaller. In the course of field studies, the question has arisen as to just how dependable dock might be as a winter emergency food, especially in localities where it was observed to be eaten freely.

Four hens (av. 2 lbs.) lost on a straight diet an average of .88 oz. per bird per day for an average of 16 days. Mean temperature: 24.7° (F.).

To me, the exceedingly poor showing of dock as an emergency food is rather surprising. It may be that the hard little achene is difficult for a bird's digestive system to open or that the available nutriment in a seed may be small in proportion to the achene coat and herbaceous calyx inclosing it. So far as nutrition is concerned, a crop full of dock fruits may be comparable to a crop full of bran mixed with a few particles of wheat.

Smartweed Lot

Achenes of wild plants belonging to the genus *Polygonum* are known to make up a substantial part of the diet of many game birds, notably quail and pheasants. In some localities they comprise the chief food of gallinaceous game during the cold weather months, although never, to my knowledge, the sole food. This much has been made clear both through field observation and through analyses of stomach contents.

To investigate still further the importance of smartweed as food, one cock pheasant (2 lbs. 10 oz.) and three hens (2 lbs. 3 oz.) were put on a straight diet of achenes, mainly those of *Polygonum pennsylvanicum* with some mixture of *P. persicaria, P. convolvulus* and other well-represented wild species.

Contrasted with the birds on the straight diet of yellow corn, those on smartweed did not maintain their weights so steadily.

The average loss rate for the smartweed lot was .26 oz. per bird per day for an average of 36 days. The mean temperature was 28.9° (F.).

For the first week the average loss was 3.3 oz. or .47 oz. per bird per day; thereafter the rate dropped to 1.5 oz. per week or .21 oz. per bird per day for the duration of the experiment.

This *diminishing* of loss rates is the reverse of what typically occurred in the course of experiments with questionable foods, but seems subject to plausible explanation.

In the first place, the birds used for experiments were game farm raised and had had little if any experience with smartweed achenes as food. They accepted the straight diet without hesitation, but the flat slippery achenes of the *P. pennsylvanicum* type passed out with the feces in volume, most of them undigested and even unbroken.

The logical supposition is that the birds, after a rather difficult first week, adapted themselves to the diet by eating more gravel or more fibrous substance to facilitate breaking up or retention of the achenes. The single bird killed for examination during the experiment was one that had been losing weight rapidly; its gizzard and intestines contained very little grit or any material except the achenes which were obviously slipping through entire in large numbers.

Bud and Catkin Lot

Ability on the part of wild gallinaceous birds to withstand winter vicissitudes has often resolved itself into a matter of being able to take advantage of woody or herbaceous vegetation as food at times when more substantial foods as seeds and grains were rendered unavailable by ice or snow covering. The habitability of some types of wild environment for different gallinaceous or other species may hinge upon whether or not a particular species can effectively resort to "budding" if need be.

The bob-white quail is not adapted to subsist upon buds, as on an exclusively herbaceous diet it loses at about half the rate that it would if it had nothing to eat at all (Errington, 1931). Conversely, the ruffed grouse is an habitual budder. Sharp-tailed grouse are known as heavy budders and prairie chickens to a lesser extent. Winter stomachs and feces of Iowa Hungarian partridges show large amounts of grass leaves and green foods.

Just where the pheasant belongs in this category has been open to question, despite the knowledge that it does eat considerable green material and has been known to bud. The experimental results, then, may be more than usually informative.

One cock (2 lbs. 3 oz.) and three hens (av. 1 lb. 14 oz.) were put on a diet of aspen and cottonwood buds (*Populus tremuloides* and *P. deltoides*), hazel catkins (*Corylus*), alder catkins (*Alnus*), with miscellaneous bud and catkin material from willow (*Salix*) and birch (*Betula*). This would approximate a subsistence diet for ruffed grouse and possibly for sharp-tails.

The average loss rate of the lot was .52 oz. per bird per day for an average of 21 days, but the loss rate for the first two weeks was comparatively low, amounting to an average of 4.4 oz. per bird or .31 oz. per day. Then the birds lost with a sud-

denness one would be tempted to call a break: 6.8 oz. per bird for the third week or nearly an ounce a day.

The mean temperature for the third week was 4.8° lower than the 31.5° (F.) mean for the experimental period, but aside from the probable effect of temperature in the loss rates, I am inclined to believe that the data show a rather unexpected ability on the part of pheasants to extract nutriment from some low grade foods, at least for several days at a time. A species capable of intermittent budding certainly has, under marginal living conditions, a survival advantage over species dependent entirely upon the frequently inaccessible concentrated foods as nuts, grains, and the more substantial weed seeds.

Mixed Questionable Food Lot

This experiment was intended to test the possibility of pheasants being able to subsist on a mixture of the foods tried out with wholly or partially adverse results, in case any of those results might be attributed to monotony of diet rather than to lack of suitability of the foods as winter staples.

The mixture consisted of the soaked greater ragweed, velvet leaf, sweet clover, coral berry, sumac, poison ivy, dock, burdock, and bud and catkin material described before. It was supplied generously and in such a way as to leave the choosing of the diet entirely up to the individual birds.

It represented, in short, very nearly the bulk of the food supply available under mid-winter conditions in some localities where repeated attempts are made to establish pheasants. Any natural shortage of lesser ragweed and smartweed, combined with a close harvest of cultivated grains, could conceivably result in a similar food picture over large areas of southern Wisconsin, eastern Iowa, and eastern Minnesota farm lands which remain persistently barren of pheasants despite the release of imported or locally reared stock.

Six hens (av. 1 lb. 13 oz.), picked veterans of previous experiments and individuals of proven adaptability, lost on this diet an average of .77 oz. per day for an average of 12 days. Mean temperature: 39° (F.).

CONCLUSIONS

On the basis of the experimental data summarized, supplemented by what information we have from stomach content analyses and field studies, we may draw a number of admittedly tentative conclusions on foods of the group intermediate between those plainly dependable as winter staples and those clearly not.

1. Fruits of fleshy consistency or those made up largely of digestion-resistant seeds are quite inadequate as winter emergency foods for pheasants. These include sumac, poison ivy, coral berry, and very likely other foods untested in the pheasant experiments, such as rose hips, dried wild grapes, bittersweet, elder berry, Virginia creeper, etc.

2. Some substantial appearing seeds as those of sweet clover and velvet leaf, while freely eaten and finely ground up during digestive processes, do not qualify as staples. Possibly toxic constituents (as alkaloids or glucosides) may be suspected in some foods of this type, although this point has not been investigated in the experiments here reported.

3. Some foods doubtless have more sustentative value when eaten with something else. Smartweed achenes which have a way of slipping unbroken through the digestive tract may be an example. Another example may be the achenes of greater ragweed which, when taken as a straight diet even when softened by moisture, fill the intestine with an apparently burdensome amount of harsh, coarse debris.

4. Buds and catkins among herbaceous foods may be of definite utility in enabling populations to survive sleet storms and temporary emergencies of this sort, as on this type of diet the daily loss rates are manifestly less than when the birds have only innutritious fruits to eat, or perhaps almost no organic material at all except for dried grasses and leaves.

In this latter respect, probably all of the emergency or non-staple foods dealt with in this paper may have some value in retarding starvation loss rates during short periods of famine. Not too much should be expected of non-staple foods nevertheless. Even though the crops of fat mid-winter specimens may

contain as much sumac as corn, it is the corn that is carrying them, not the sumac.

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THE CHASE JOURNAL: AN EARLY RECORD OF WISCONSIN WILDLIFE

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In building technique for wildlife restoration, it is of great value to have precise and dependable records of its decline. Usable records are scarce. A usable record is one in which all variables but one tend to be averaged out, either by a long span of space, or by a long span of time.

A shooting journal is valuable when it presents the bag of an individual or fixed group, hunting one locality, by one method, at regular intervals, through a long period of years. Such a record is the W. H. Chase Journal, recently presented to the Wisconsin Historical Library. This digest and analysis is prepared to make its contents available to other students.

Walter Howard Chase began the Journal in 1873 at the age of fifteen and continued it through 1896, when he moved to Sullivan, Illinois. He died in 1934.

The Journal recorded his bag by species for each calendar year from 1873 to 1896. There are no notes or comments except an annual note on the opening and closing dates of Lake Wingra, and another dividing the duck bag as between spring and fall. The page for 1879 is missing, the stub bearing evidence of childish fingers wielding a scissors at some later time. The year 1895 is also missing.

Lake Wingra, with its immediate environs, was the theatre of the hunting operations. It is one of the five "Madison Lakes" and lies on the outskirts of Madison, Dane County, Wisconsin. Part of the terrain is now covered with suburban residences, a municipal park, and a golf club; the remainder lies largely within the University of Wisconsin Arboretum. Since the Arboretum is now a centre for wild life research work, this record of its early fauna is of special interest.

The general accuracy of the Journal is attested by attendant circumstances. The bags are recorded by tally marks, entered in changing inks, pens, and pencils, which means they were tal-

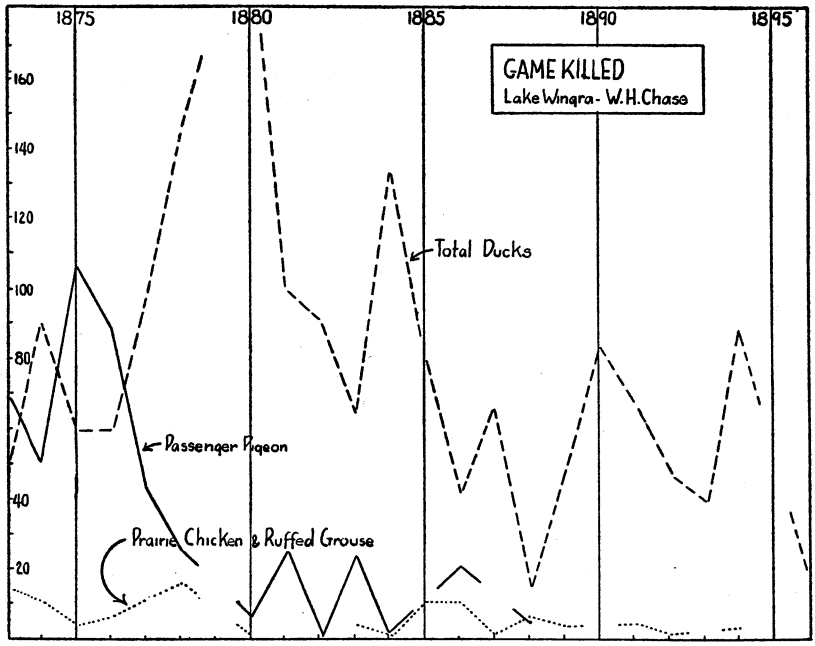

Fig. 1. Game killed around Lake Wingra by W. H. Chase.

lied currently, and not "estimated" at the end of the season. Chase also collected an herbarium of 1,000 plants, now a part of the University Herbarium. The species determinations attest his competency as an amateur naturalist.

The Chase home, in which W. H. Chase lived during the period of the Journal, is on the shore of Lake Wingra. Dr. Samuel H. Chase, his brother, tells me that his hunting ground was bounded on the north by "Marston's Woods" (now Nakoma) and on the east by the "Dead Lake Ridge," a moraine dividing Lake Wingra from Lake Monona. Toward the west it extended at times as far as Verona. Toward the south it included all of the peat and marl lowlands, then known as the "Big Marsh," now comprising the east end of the Arboretum. Ducks were hunted with boat and decoys, but often also by jump-shooting. Dogs were used during the entire recorded period, the names of three appearing on the cover of the Journal. W. H. Chase fished in other counties of the state, but seldom if ever hunted there, hence the bags in the Journal are quite surely local to the Wingra area.

TABLE I.

W. H. CHASE JOURNAL. GAME KILLED ON AND NEAR LAKE WINGRA, MADISON, WISCONSIN

Journal Names	Author's Identification	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	Total	Bag Composition Per cent
Redhead					12	8	1		1	4	8	3	3	6			1				1	1	3			52	4
Canvasback															1		2									3	
Bluebill	Lesser Scaup? Ringneck?				15	43	78		28	20	16	15	24	24	5	2		10		11	20	7	39		12	369	25
Scaup Duck	Greater Scaup?								14	9	13	6	31	12	12	26			5							128	9
Whistler	American Goldeneye				2	1			1				4	6	2											16	
Butterball	Bufflehead				2	5	10		12	4	8	5	2	5		2					6	10	2	3	2	78	5
Ruddy Duck										1	1	1					1		1							5	
Mergansers	(Undifferentiated)						(2)			(1)						(1)							(1)			(5)	
Old-wives	Old Squaw				7	3	3																			13	1
Mallard					1	3	7		37	2	7	7	23	7	10	6	2	18	18	17	9	6	10			190	13
Widgeon									1	1			2			2	1	1	3		1	6	4	2		24	2
Spoonbill	Shoveller						4		4		1	1	3							1			1			15	1
Greenwing Teal	(Including undifferentiated teals)	(species not differentiated)			(20)	(20)	(33)		78	45	20	9	14	15	8	15	6	3	22	7	2	(12)	10			339	21
Bluewing Teal									22	1	5		2	1	2	3		6	8	1			4			55	5
Wood Duck					1	9	4		7	10	13	16	19	1	5	9		11	18	19	2	5	12			161	11
Pintail						3			7	2		1	6	4			1	4	9	5	2					44	3
Gray Duck	Gadwall?					1	2																			3	
TOTAL DUCKS		(50)	(90)	(60)	60	96	144		212	100	92	64	133	81	45	66	14	53	84	67	47	39	87		16	1500	100
Pigeon	Passenger Pigeon	70	50	105	88	43	25		7	25	1	23	2		20		4									463	
Snipe		25	10	10	15	8	3		12	10			4	5	9	10	4	37	6	6	4	8	14			200	
Woodcock		1	2	2	1									1	3			2	2							14	
King Rail		7	15	10																						32	
Plover	?			2			1					1		2	2	1	2	2	2	2	1		3			21	
Partridge	Ruffed Grouse	10	9	4	7	7	15		2			3	1	10	8	1	7	3		3	1		3			94	
Chickens	Pinnated Grouse	4	2			4									2			2								14	
Quail	Bobwhite		1						1																	2	
Rabbit	Cottontail	5	3	6		3	8		10			1	3	8	5	8	2	9	8	13	2					94	
PER CENT OF DUCKS KILLED IN SPRING						16	28		17	7	11	8	24	47	7												

I have summarized the bags by species and years in table 1. The trend of the bag in certain species is depicted in the graph (Fig. 1). On Dr. Samuel H. Chase's authority, I have lumped two "summer ducks" with wood duck in the table, also nine "winter ducks" with goldeneye. These are evidently slips into the local vernacular. The distinction in the table between "Scaup" and "Bluebill," and the identity of "gray duck" as gadwall, may both be considered as doubtful. "Bluebill" probably includes Ringnecks. The identity of "plover" I have not ventured to guess. Certain bags of rails, blackbirds, mudhens, bitterns, cranes, hawks, owls, skunks, muskrats, and an eagle appear during the youthful period, all undifferentiated as to species. These are omitted from the table for brevity. Undifferentiated teals and mergansers appear in parenthesis.

Passenger Pigeon. Chase witnessed only the closing scenes of the pigeon tragedy. W. B. Mershon (pp. 113, 115) states that the last big Wisconsin nestings were at Eau Claire, Tomah and Augusta in 1871. This was two years before the Journal began in 1873, but Chase nevertheless bagged 70 pigeons in that year. Mershon (p. 152) mentions an unverified report of a nesting southwest of Lac Vieux Desert in 1874, and of another near Fort Atkinson about the same time. Both would fall within the Journal period.

Dr. Samuel H. Chase, who was born in 1873, remembers as a boy seeing pigeons in the "Sisters' Woods" adjoining the Chase residence. They were so thick as to weigh down the oak trees from which they were gathering mast, and so close that he could see the ripple in each lustrous throat as each acorn "went down." This must have been in about August 1882, a decade after the last verified* Wisconsin nestings, and six years before W. H. Chase bagged his last pigeon in 1888. Dr. Samuel H. Chase saw his last pigeons in 1885—a spring flock of 12 birds. Mershon records the last scattered Wisconsin flocks as seen in Florence county in 1884, Lake Winnebago 1897, and Lake Butte des Morts 1897. The record ends with the single bird killed by Emerson Hough at Babcock about 1900.

The conclusion is that the disappearance of Wisconsin pigeons was no sudden debacle—they occurred in decreasing numbers for nearly three decades after the big nesting of 1871.

* A. W. Schorger has since recorded nestings in 1882.

Ducks. The percent composition of the kill (last column on right in table) indicates the former relative abundance of species on Lake Wingra. Scaup, greenwing teal, and mallard comprise 59 per cent of the recorded bag.

Aside from this question of composition of the kill, the main value of the duck record is as possible evidence of trends in duck abundance.

The annual kill from 1873 to 1880 shows a steady climb (see graph), but this may represent the mounting proficiency of the youthful hunter, rather than any trend in duck abundance.

Between 1880 and 1888 follows a nearly continuous decline. This spans the ages of 22 to 30, when most hunters are approaching their maximum of zest and skill, hence it is reasonable to postulate a decline in local birds. Can we account for such a trend?

It is common knowledge that Wingra is now spoiled as a duck lake, presumably by carp. Cole (p. 547) shows that carp were first introduced into Wisconsin about 1879, just previous to the apparent decline in Wingra ducks. Dr. Samuel H. Chase, however, did not notice carp in Wingra until the late nineties. The possible role of carp thus seems beset by contradictory evidence.

The decade following 1888 shows, in general, a rising curve, ending in a sharp decline after 1894. This decline coincides with the general drouth of the early nineties (Streiff, p. 294). E. R. Jones, State Drainage Engineer, tells me that undrained peat marshes in central Wisconsin suffered deep burns in 1894. This is the only known Wisconsin record of widespread peat fires previous to drainage, and indicates extremely low water tables.

Wing, in his exploration of waterfowl cycles, shows a Brant bag curve (p. 349) for Monomay Island, Massachusetts. The general trend parallels the Brückner cycle of the sun, but during the two periods here under consideration, the trend is opposite that of the Chase curve. The minor oscillations, however, include a number of coincidences with the Chase curve: a low in 1888, a high in 1891, a low in 1893, a high in 1894, and a low in 1896.

The only conclusion which can be drawn is that if many local journals could be fused into one continuous record, it might shed important light on past fluctuations in waterfowl.

The abrupt termination of Old Squaws after 1878, after appearing in the bag for the three preceding years, is suggestive of sporadic changes in the movements of this species. Schorger records the reappearance of Old Squaws on the Madison Lakes in 1913, 1925, and 1929. The bird seen in 1929 was in the Nakoma Golf Club spring near Lake Wingra.

Woodcock. The small kill, all grouped in two periods, is suggestive of fluctuating abundance. Howard F. Weiss saw 22 woodcock in one day on the Arboretum in April, 1933, and I soon after saw 18. All three of these possible "highs" fall in periods of apparent duck scarcity.

Phillips thinks New England woodcock increased during the years just previous to 1925.

Leopold and Schorger (p. 189) record a decrease of jacksnipe in Dane County during the period 1919-1929, since followed (in my opinion) by an increase during the present period of duck scarcity.

All these fragments collectively suggest the need for an investigation of shorebird population levels, including a possible fluctuation inverse to ducks.

King Rail. This species is still an uncommon but regular breeder on Wingra. Again the lumping of the bag in the period 1873-1875 is suggestive of fluctuating abundance. Dr. Samuel H. Chase remembers these birds as common about the family boathouse in the late 70's when he was a small child, but he killed none until about 1889. This suggests an intervening period of scarcity.

Ruffed Grouse and Prairie Chicken. Ruffed Grouse disappeared from the Wingra woods just before the establishment of the Arboretum. Cahn found them present yearlong in 1915. It is hoped that they can be reintroduced. Prairie chickens are still present at times, but in very small numbers. A single brood was raised in 1934.

The absence of sharptails from the record indicates they either never occurred on Wingra, or had disappeared before the 70's. There is still a single remnant in Dane County.

It is notable that when chickens were killed at all, it was in years of high bag in ruffed grouse. This corroborates the general assumption that these two species share the same cycle.

But what cycle? According to Wing (p. 359), the most probable fluctuation to be looked for in southern Wisconsin is the solar "half cycle" of five or six years, which peaked in 1871, 1878, 1884, and 1889. The Chase bag apparently peaks just before 1873, in 1878, in 1885-6, and again about 1888. Of course, in such a slender bag record neither agreement nor disagreement with the cycles is to be considered as anything more than a hint of possible relationship.

Quail. The extremely small bag of two quail in 24 years is noteworthy. It hardly seems likely that a young hunter with enough shells and hunting appetite to shoot Soras, and a good dog to boot, would either have passed up quail in the field or failed to record them if shot. One is forced to the conclusion that quail were scarce or absent during the Journal period.

Contrast this with the following recent census figures for the Arboretum:

Year	Authority	Fall Census (December)	Spring Survival (April 1)
1929-30	Errington	37	23
1930-31	Errington	67	58
1931-32	Errington	70	46
1932-33	Errington	41	41
1933-34	Leopold	128?	..
1934-35	McBeath	..	35

These censuses represent the quail population on a somewhat variable area, but an area always *much smaller* than that hunted by Chase. Winter feeding has been practiced only since 1933-34. One is forced to conclude that quail, at least around Wingra, are much more abundant now than during the Journal period. This conclusion is negatively sustained by Leopold's chart (Game Survey, p. 76), which records no quail highs in Wisconsin during the Journal period, except one in the northwestern counties in 1896. It is positively sustained by Dr. Samuel H. Chase's recollections—he remembers that his father regarded as quite a curiosity a pair of quail appearing in the family yard about 1885.

All of the speculations in this paper concerning population levels are recorded not as conclusions, but as a provocation to other investigators who may have opportunity to compile other journals, and thus ultimately make conclusions possible.

Lake Record. The Journal records the following dates for the opening and closing of the ice on Lake Wingra:

	1877	1878	1879	1880	1881	1882	1883	1884	1885
Lake opened	.....	Mar. 9	Mar. 29	Mar. 23	Apr. 29	March. 2	Apr. 10	Apr. 13	April. 13
Lake closed	Dec. 29	Dec. 6	Nov. 19	Nov. 16	Nov. 20	Dec. 2	Nov. 15	Nov. 24	Dec. 5

	1886	1887	1888	1889	1890	1891	1892	1893	1894
Lake opened	Apr. 15	.....	Apr. 13	Mar. 24	Mar. 24	.....	Apr. 2	Apr. 5	Mar. 10
Lake closed	Nov. 24	Nov. 20	Dec. 12	.....	Dec. 4	.....	Nov. 18	Nov. 17	Nov. 15

	1895	1896
Lake opened	.....	Mar. 30
Lake closed	.....	.....

On the page for 1881 appears a note: "Water highest ever known to me." Evidently this reflects "The Big Snow" which fell in February and March of that year (unpublished records of U. S. Weather Bureau, Madison).

The original Journal may be consulted at the Wisconsin Historical Library.

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TEACHING WILDLIFE CONSERVATION IN PUBLIC SCHOOLS

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Teaching of conservation in public schools is made compulsory by a new Wisconsin statute (319 S., 1935).

The bill was sponsored by the Federation of Women's Clubs and other laymen's organizations. It reflects, in general, a conviction that the conservation movement needs a wider base in public sentiment. It assumes that the schools, if so directed, can build this base.

It probably also reflects a belief, less articulate but perhaps equally potent, that natural history "hobbies" act as an antidote for the excessive mechanization of society, and as an absorbent for expanding leisure—hence, that their cultivation in schools is conducive to "the good life."

The law, and probably most of its sponsors, no doubt assume that the subject matter to be taught is all in existence—that the only thing needful is a public mandate to give it place in school curricula. The purpose of this paper is to discuss the degree to which this assumption is correct, the degree to which available subject matter has been prepared for use in schools, and the facilities for training teachers to use it.

The discussion is limited to that part of the conservation field dealing with wildlife, *i.e.*, birds, mammals, and non-commercial plants.

SUBJECT MATTER FOR TEACHING

Presumably the subject matter to be taught must, except as it deals with pure esthetics, exist as science before it can be translated by teachers for popular use. To what extent does it exist?

To analyze this question, each species may be considered from four exterior aspects (the internal workings are, for simplicity, not considered):

1. Its form and origin as a species (taxonomy).

2. Its behavior as an individual (natural history).
3. Its relationship as a population in an environment (ecology).
4. Its possible control by manipulating the environment (applied ecology or management).

These four categories happen also to represent the successive developmental stages in biological science.

In my opinion the biological basis for teaching is ample for No. 1, but dwindles progressively through Nos. 2, 3, and 4. Stage 4 may be said to have the beginnings of an existence for certain species of game and fish, but for fur animals it exists in name only, while for songbirds and wild flowers there is not yet even a name for culture in-the-wild. The ecology of all these groups (stage 3) is very fragmentary. Not till we get back to individual behavior (stage 2) can there be said to be an adequate basis for popular teaching. Stages 2 and 1 jointly comprise the bulk of those large aggregations of knowledge now called ornithology, mammalogy, and botany.

The needs of conservation are exactly converse to the progress of these stages in biological science. Conservation depends for its accomplishment on manipulation of environments, of which we as yet know little. It is not helped much by the science of evolutionary origins, of which we know much. It is evident, then, that popular teaching of conservation must be lopsided until science catches up to its needs. (This is, of course, no argument for delaying the teaching job. It is an argument for speeding up the construction of the scientific base.)

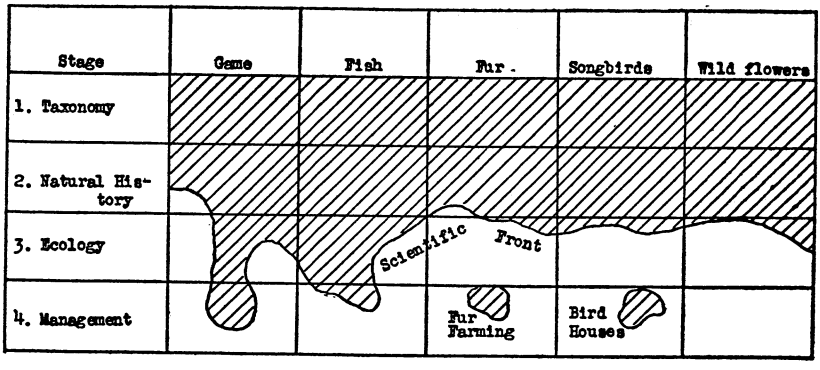

Fig. 1. Scientific base for teaching Wild Life Conservation.

Fig. 1 attempts to portray the situation in graphic form. The irregular "scientific front," with outposts of advance knowledge, is not devoid of actual meaning. Thus fish management, while only a few years old, is backed by a much larger accumulation of ecological data than game management, which is older and has gone farther into technique. The accumulated findings of Birge and Juday in the ecology of lakes, for example, have no counterpart in game. There is, however, no corresponding knowledge of the ecology of streams, although the existing technique is mostly for streams. Hence the fish management "peninsula" is portrayed in the figure as not perpendicular to its base.

Again, songbird management, while in general non-existent as a professional and scientific field, and not as yet backed by any considerable body of ecological knowledge, nevertheless contains an advance post of technique: artificial bird-houses and artificial feeding. A well-developed technique for hole-nesting birds was published by von Berlepsch as early as 1908.

Fur farming likewise is an island of technique. There is as yet no body of knowledge on wild management and ecology to connect it with the natural history of fur species. Game farming was a similar outpost until the recent expansion in wild management connected it with "mainland."

The most serious re-entrant in the scientific front is in the ecology and management of wild flowers. There exists, of course, a large amount of ecological work in botany, but its objective has been to explain evolution and distribution, rather than to serve as a base for culture in the wild. Much of it will be convertible for the latter purpose, but in and of itself it does not suffice for teaching conservation.

Ecology and Conservation

Avocations in natural history can, of course, be taught, as in the past, in sole reference to identification and habits of species. No one possessed of such a hobby would deny its value as a source of personal pleasure and enlightenment. Its value as a base for conservation sentiment, however, is, I think, less than will be the case when the same hobby is rounded off to include an interest in ecological and management questions. Why? Because the forces which threaten wildlife emanate from its en-

vironment, and their operation cannot be understood by a public versed only in names and habits of species. Such a public, as a critic of conservation policies, is equivalent to a person having a wide personal acquaintance, but no knowledge of business, as a critic of politics or economics. Both lack an "inside" picture of the struggle for existence. Ecology is the politics and economics of animals and plants.

The citizen-conservationist needs an understanding of wildlife ecology not only to enable him to function as a critic of sound policy, but to enable him to derive maximum enjoyment from his contacts with the land. The jig-saw puzzle of competitions and cooperations which constitute the wildlife community are inherently more interesting than mere acquaintance with its constituent species, for the same reason that a newspaper is inherently more interesting than a telephone directory.

Teaching Teachers

Of 30 students in the 1936 farmers' short course in game management at the University, 4 professed, in personal interview, a special interest in natural history derived from their teachers. Four others had derived such an interest from family or friends. Twelve had read natural history books from school libraries. This may be a valid sample of the spread and effectiveness of conservation teaching to date.

It was very noticeable that the teachers who had awakened such interests had done so by the contagion of their enthusiasm, rather than by merely transmitting information.

The question is: By what means can the proportion of such "carriers" be increased?

My guess is that the chief utility of compulsory laws is to lend official sanction to pre-existing enthusiasms among teachers, and to stimulate the preparation of good courses, texts, exhibits, and other overhead services.

The courses now offered teachers in universities (and presumably in normal schools) are certainly *not* designed to encourage them either to develop avocations in wildlife, or to teach such avocations to children. The University of Wisconsin, through its "Science Inquiry," is now aiming to remedy this defect. A complete remedy must, of course, await the straightening of the "scientific front" already discussed.

Teaching Materials

The offhand way in which resolutions committees delegate to unspecified "scientists" the job of preparing conservation textbooks is, I fear, mere wishful thinking. There seems to be little realization of the fact that to write a really competent non-technical conservation text, which shall fairly cover the component fields and be at once sound science, sound policy, and sound pedagogy, is a task calling for very uncommon mental powers, not to mention time and funds. It is a task at least as exacting as the scientific fact-finding which underlies it. Such a text is harder to write than the equivalent thing for adults, and no recent writer has fairly translated conservation for adults. Van Hise's classical "Conservation of Natural Resources" was written before ecology was born, and before the management idea had been applied to anything but forests. No equally competent interpretation of the wider vista now confronting us has appeared, unless it be Paul Sears' "Deserts on the March." "Little Waters," by Person, Coil, and Beall, is similar in its approach, but covers the much more limited field of soil and water.

All these attempts to paint a continental picture of conservation suffer from one inherent handicap: it is impossible to give specific examples portraying the biotic mechanism, because examples that hold for one region do not hold for another. Only scientific laws can be generalized and yet remain true. It is therefore my prediction that the ultimate "text on conservation" will treat of only one region, or possibly only one state.

There are, of course, many competent texts, each covering the natural history of some one particular field, such as birds, mammals, or flowers, but these fall far short of covering its ecology or management. They are of great value in presenting to us the alphabet of conservation, but they do not build ecological words or sentences out of the species they teach us to recognize. Most such texts seem either unaware of the provinces beyond the scientific front, or else dismiss them with a few personal opinions on legislation. One English writer (Elton) has given us a thoroughly competent popular rendition of animal ecology, but there has been no equally good job on this side of the water.

There is also a growing array of teaching materials, each covering some small fraction of some single field. Many of these

fractional treatments have real value because they do a small job well, and do not pontificate on what lies outside its boundaries. As examples may be mentioned the regional series of Biological Survey leaflets, mostly by McAtee, on "How to Attract Birds," the Audubon bird leaflets, and John May's "Hawks of North America."

Some of the new teaching materials have special value to teachers as illustrations of how divergent conclusions can be drawn from identical facts. Contrast, for example, the Emergency Conservation Committee's "Teaching Units" with Senator Hawes' "Fish and Game, Now or Never," or with the equivalent philosophy expressed piecemeal by sporting magazines. There is one peculiarity common to both sides of this controversial literature. Like medieval theology, it expresses its discontent in the pattern of a personal devil, who stands in urgent need of demolition by the writer. The protectionist's devil is usually the sportsman. The sportsman's devil is usually "vermin," or the "game hog," or some other visible malefactor. The invisible deterioration of habitat which causes the real damage, and to which both kinds of crusaders are at least indirectly a party, is commonly ignored or dismissed as incidental. The end-objective of conservation teaching must be, I think, to show the prospective citizen that conservation is impossible so long as land-utility is given blanket priority over land-beauty. In short, it is his personal philosophy of land use, as well as his vote and his dollar, which will ultimately determine the degree to which the conservation idea is converted from preachment into practice.

Here and there we note the emergence of attempts to piece together into coherent schoolroom sentences the alphabet devised by taxonomy and natural history. One such is "Exploring Michigan's Resources,"—clever pedagogy, comprehensive of the whole field, but perhaps a bit pat, and a bit tinctured with the flavor of tourist-bureau. The Chamber of Commerce should not wish its job on the schools. I would like to see Michigan ask Harold Titus to do this over in the style of his "The Old Game Warden"—a really remarkable attempt to translate wildlife ecology and management into the lay-jargon of sportsmen.

A list of teaching materials available to Wisconsin teachers is incorporated in the references for this paper. The list is of course not exhaustive, even for wildlife in this state. It omits

all nonpopular and most expensive titles, as well as most titles sold for commercial profit. A full endorsement of all titles is not implied. The list is offered merely as a start toward the laborious job of sifting and rounding-out which must underlie the execution of the new law.

The most serious defect in the whole collection of teaching materials is the absence of the phrase "we don't know." Just why are we so undemocratic in professing ignorance? It seems a special privilege of scientists.

The need for teaching materials of course goes far beyond printed matter. Museums have long ago seized upon exhibits and movies as vehicles for teaching taxonomy and natural history, but they are not yet used for portraying ecology or management. What we label "conservation films" are so far mostly either propaganda or entertainment. Conservation exhibits do not yet exist.

Schools and universities need nearby pieces of land on which conservation problems and techniques can be shown, and researches performed. School forests are a move in this direction, but why not also school refugees, management areas, and floral preserves? The University of Wisconsin Arboretum and Refuge is being developed in such a direction and will serve, among other purposes, as a training area for prospective teachers of conservation.

SUMMARY

The scientific base for teaching conservation is lopsided. The subject matter so far most developed is not that most needed for this purpose.

The biological institutions of Wisconsin will overlook an important opportunity if they fail to amplify this base, especially in the ecology and management of fur, songbirds, and wildflowers.

No adequate "text on conservation" for schools has so far appeared. The ultimate text will probably be regional.

There is much good natural history material which may be regarded as the alphabet for such a text.

The controversial literature of conservation is of interest to teachers as illuminating the philosophical questions involved.

Films, exhibits, and demonstration areas should be developed for teaching purposes.

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Von Berlepsch (compiled by M. Hiesemann). *How to attract and protect wild birds.* Witherby & Co., London, 1907. Out of print).

(B) Partial list of non-technical publications suitable for use by teachers or essential to school libraries

Handbooks for identification of species:

A Field Guide to the Birds. Roger Tory Peterson. Houghton Mifflin Co., New York. $2.75.

Birds of Minnesota. Thomas S. Roberts. University of Minnesota Press, Minneapolis. 2 vols. (Out of print, but available in many libraries. Plates alone still issued as an abridged volume.)

Spring flora of Wisconsin. N. C. Fassett, Botany Department, University of Wisconsin. $1.00.

Forest trees of Wisconsin. Fred G. Wilson. Conservation Department, Madison. 15c.

The hawks of North America. John B. May. National Association of Audubon Societies, 1775 Broadway, New York City. $1.25.

The orchids of Wisconsin. Albert M. Fuller. Milwaukee Public Museum, 1933.

Educational leaflets on each of 140 bird species. National Association of Audubon Societies, 1775 Broadway, New York City.

Non-technical bulletins on management, applicable to Wisconsin:

Wisconsin prairie chicken investigation. Alfred O. Gross. Wisconsin Conservation Department, Madison.

Winter feeding of wild life on northern farms. Wallace Grange, U.S. D.A. Misc. Publ. No. 159, Washington.

Improving the farm environment for wild life. Wallace Grange. U.S. D.A. Farmers' Bulletin No. 1719, Washington.

The Hungarian Partridge in the Great Lakes region. Ralph E. Yeatter. Bulletin No. 5, School of Forestry & Conservation, University of Michigan, Ann Arbor.

Suggestions for pheasant management in southern Michigan. H. M. Wight. Department of Conservation, Lansing, Michigan.

Game Survey of the North Central States. Aldo Leopold. (Out of print, but vaailable in some libraries.)

How to attract birds in the east central states. W. L. McAtee. U.S.D.A. Farmers' Bulletin No. 912, Washington.

Local bird refuges. W. L. McAtee. U.S.D.A. Farmers' Bulletin No. 1644, Washington.

Homes for birds. E. R. Kalmbach and W. L. McAtee. U.S.D.A. Farmers' Bulletin No. 1456, Washington. 5c.

Usefulness of birds on the farm. W. L. McAtee. U.S.D.A. Farmers' Bulletin No. 1682, Washington. 5c.

The foods of some predatory fur-bearing animals in Michigan. Ned Dearborn. Bulletin No. 1, School of Forestry and Conservation, University of Michigan, Ann Arbor.

General Pamphlets, public agencies:

Conservation outline of Wisconsin. Conservation Department, Madison.

Exploring Michigan's resources in the Junior High School classroom. Department of Conservation and Department of Public Instruction, Lansing, Michigan.

Three boys go camping. Department of Conservation and Department of Public Instruction, Lansing, Michigan.

Misc. pamphlets, private associations:

Teaching Units of the Emergency Conservation Committee, 734 Lexington Avenue, New York.

Furs, Fins and Feathers. Successful Farming, Des Moines, Iowa.

Publications by "More Game Birds in America, Inc.", 500 Fifth Avenue, New York City:
Small Refuges for Waterfowl
Water Areas, How to Create and Maintain Them
Waterfowl Food Plants
Quail Breeding Manual
Pheasant Breeding Manual

Non-technical periodicals on birds suitable for teachers and school libraries:

Bird-Lore. National Association of Audubon Societies, 1775 Broadway, New York. Subscription, $1.50 per year.

Wilson Bulletin. Wilson Ornithological Club. (Dr. Lawrence E. Hicks, Botany Department, Ohio State University, Columbus, Ohio.) Subscription, $1.50 per year.

SOME EARLY BIRD RECORDS OF WISCONSIN AND NEIGHBORING TERRITORY TO THE WEST AND NORTH (1896-1900) AND OF INDIANA (1876-1877).*

M. E. PINNEY AND J. F. MACNAUGHTON
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INTRODUCTION

It is a well recognized fact that the species of birds found common to certain areas of the country may change greatly in the course of time, due to the gradual extinction of some birds, and variations in the routes of others. In view of this knowledge, it has been thought of some little importance to compile a list of the skins belonging to the collection made by Dr. H. V. Ogden and Dr. E. C. Copeland of Milwaukee, a list which would be available to anyone interested.[1] The collection is among the oldest made in this locality, having been assembled during the period from 1875 to 1905. As such, therefore, it is of historical interest. The specimens included are birds that were common to various regions at the time the collection was made, and that are, for the most part, still found in those localities. Of the approximately 360 species that have been officially recorded in Wisconsin, 120 are represented in this collection. Its chief value lies in the fact that it furnishes permanent and reliable records of many birds that were common to the vicinity at that time.

The reason for the making of this collection was evidently the absorbing interest in birds entertained by Dr. Ogden and Dr. Copeland, for although the specimens became the property of Dr. Ogden, approximately half of them were accumulated by Dr. Copeland. It is obvious from the recorded dates and localities, that the two men, sometimes in company with a third, Mr. H. Russell, collected together on various hunting and fishing trips. Miscellaneous additional specimens were obtained from Mr. L. Kumlien, Mr. N. Hollister, Mr. J. H. Wurdemann and Mr. C. J. Allen.[2] For the most part, the birds were collected casually by Dr. Ogden, and although other localities are represented, naturally, most of the skins are those of birds from the

*Compiled from the Ogden-Copeland Collection of Bird-Skins.

region surrounding Milwaukee. Dr. Copeland's work with Jordan in Indiana, 1876, and the joint efforts of Dr. Ogden and Dr. Copeland in Minnesota, 1897, and in North Dakota, 1899, added many specimens to the collection.

For the sake of clearness, the birds as listed below have been divided into four groups, according to the localities in which they were collected: (1) Birds of Wisconsin, (2). Birds of Northern and Western States, (3). Birds of Central and Southern States, and (4). Birds of miscellaneous localities. Each group has then been subdivided into more specific areas, although in most cases, there is no definite physiographical relationship between the counties making up the group. The first division of group (1), consisting of Milwaukee, Racine and Ozaukee counties, is the one which shows the most striking similarities in physiography, since the area borders on Lake Michigan. Due to the narrowness of Milwaukee County, however, and the probability that the majority of specimens which were collected in Waukesha county were collected in its eastern portion, Waukesha county, though inland, has been included with this division. Jefferson and Walworth counties, though adjoining this territory were regarded as too far inland to show the characteristic avifauna of the region, and so birds from those counties were listed in an appendix. In the same way the birds of Douglas county have been separated from those of Vilas and Iron counties, for although all three counties lie in the northern portion of the state, Douglas county is considered too western to be properly included in the group.

The classification, order of arrangement of birds and terminology used in the compiling of this list are those employed by the committee of the American Ornithologist's Union in the preparation of the fourth edition of its *Check-List of North American Birds,* which was published in 1931[3]. Therefore, many of the names appearing in the list are not identical, although they are synonymous, with those found upon the collector's tags. The change was made for the purpose of making the list conform to the most recent standard. It might be added that while the labels on many of the specimens do not bear the name of the collector, we have not regarded the omission as in any way weakening the authenticity of the record and so have included all such records in our list. This is true, chiefly of the specimens

from Vilas and Iron counties which were undoubtedly obtained by Dr. Ogden and Dr. Copeland from the collection of Mr. L. Kumlein and Mr. N. Hollister.

For kindly assistance in the preparation of this paper we are indebted to Mr. Gardiner P. Stickney of Milwaukee who contributed information concerning the history of the collection, to Dr. H. C. Oberholser and his assistants of the Bureau of Biological Survey who have identified the doubtful specimens and to Dr. A. W. Schorger who has examined the list critically and so helped us avoid many errors.

BIRDS OF WISCONSIN

I. MILWAUKEE, WAUKESHA, RACINE, AND OZAUKEE COUNTIES

Order GAVIIFORMES
Family GAVIIDAE

1. *Gavia immer elasson Bishop. Lesser Loon (7a).*
   H.B.H. Sept. 1900.

Order COLYMBIFORMES
Family COLYMBIDAE

1. *Colymbus auritus Linnaeus. Horned Grebe (3).*
   H.V.O. Apr. 22, 1897.
   H.R. Apr. 21, 1897.

Order PELEBANIFORMES
Family PHALACROCORACIDAE

1. *Phalacrocorax auritus auritus (Lesson). Double-crested Cormorant (120).*
   H.V.O. Oct. 14, 1900.

Order CICONIIFORMES
Family ARDEIDAE

1. *Ardea herodias herodias Linnaeus. Great Blue Heron (194).*
   H.V.O. June 6, 1897.

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[1] The collection itself is now in the possession of Milwaukee-Downer College, so that the specimens are and probably will always be accessible to anyone for reference.

[2] The Collectors' names as abbreviated in the list are:

H.V.O	Dr. H. V. Ogden.
E.C.	Dr. Ernest Copeland.
H.R.	Mr. H. Russell.
L.K.	Mr. L. Kumlien.
J.H.V.W.	Mr. J. H. Wurdemann.
C.J.A.	Mr. C. J. Allen.
N.H.	Mr. N. Hollister.
W.A.B.	?

[3] The only exceptions to this usage are:
Troglodytes domesticus baldwini, pp. 0 and 00, and *Limnodromus griseus hendersoni*, p. 00. which have been named for us by Mr. A. H. Howell and Mr. Thomas D. Burleigh of the U. S. Bureau of Biological Survey.

2. *Butorides virescens virescens (Linnaeus). Eastern Green Heron (201).*
   H.V.O. May 5, 1899.
   H.V.O. May 15, 1897.
   H.R. May 20, 1897.

3. *Botaurus letiginosus (Montagu). American Bittern (190).*
   H.R. *May 11, 1897.*
   H.R. May 21, 1897.

4. *Ixobrychus exilis (Gmelin). Eastern Least Bittern (191).*
   H.V.O. May 20, 1897.
   H.V.O. June 9, 1899.

Order ANSERIFORMES
Family ANATIDAE

1. *Spatula Clypeata (Linnaeus). Shoveller (142).*
   H.V.O. Apr. 13, 1897.
   H.R. Apr. 13, 1897.

2. *Aix sponsa (Linnaeus). Wood Duck (144).*
   HVO. Apr. 13, 1897.

3. *Nyroca affinis (Eyton). Lesser Scaup Duck. (149).*
   H.V.O. Mar. 29, 1897.
   H.R. Mar. 29, 1897.
   E.C. Mar. 29 1897.

4. *Glaucionetta clangula americana (Bonaparte). American Golden-eye (151).*
   H.V.O. Mar. 26, 1897.
   H.V.O. Feb. 12, 1899.
   H.R. Apr. 14, 1900.
   E.C. Mar. 27, 1897.

5. *Charitonetta albeola (Linnaeus). Bufflehead S. C. (153).*
   H.R. Apr. 1, 1897.

5. *Charitonett albeola (Linnaeus). Bufflehead (153).*
   H.V.O. Mar. 30, 1897.
   H.V.O. Feb. 5, 1899.
   H.R. Mar. 29, 1897.
   H.R. Feb. 5, 1899.

7. *Somateria spectabilis (Linnaeus). King Eider (162).*
   H.R. Dec. 25, 1899.
   H.R. Jan. 7, 1900.

8. *Oidemia americana Swainson. American Scoter (163).*
   E.C. Oct. 1895.

9. *Erismatura jamaicensis rubida (Wilson). Ruddy Duck (167).*
   H.V.O. Apr. 20, 1897.
   H.R. May 2, 1897.

10. *Mergus merganser americanus Cassin. American Merganser (129).*
H.V.O. Apr. 2, 1897.
H.R. Mar. 26, 1897.
E.C. Apr. 2, 1897.
C.J.A. Apr. 1, 1897.

11. *Mergus serrator Linnaeus. Red-breasted Merganser (130).*
H.V.O. Mar. 26, 1897.
H.V.O. Mar. 31, 1897.

Order FALCONIFORMES

Family ACCIPITRIIDAE

1. *Buteo borealis borealis (Gmelin). Eastern Red-tailed Hawk (337).*
H.V.O. Nov. 5, 1899.

Family FALCONIDAE

1. *Falso sparverius sparverius Linnaeus. Eastern Sparrow Hawk (360).*
H.V.O. Mar. 18, 1898.

Order GRUIFORMES

Family RALLIDAE

1. *Rallus limicola limicola Vieillot. Virginia Rail (212).*
H.R. May 6, 1899.

2. *Porzana carolina. (Linnaeus). Sora (214).*
H.V.O. Sept. 9, 1899.
H.V.O. Apr. 23, 1897.

3. *Fulica americana americana. Gmelin. American Coot (221).*
H.R. Oct. 1, 1899.
Sept. 24, 1898.

Order CHARADRIIFORMES

Family SCOLOPACIDAE

1. *Philohela minor (Gmelin). American Woodcock (228).*
H.V.O. May 9, 1897.

2. *Actitis macularia (Linnaeus). Spotted Sandpiper (263).*
H.V.O. May 17, 1896.

3. *Pelidna alpina sakhalina (Vieillot). Red-backed Sandpiper (263).*
E.C. May 16, 1899.

Family LARIDAE

1. *Larus argentatus smithsonianus. Coues. Herring Gull (51a).*
H.V.O. Nov. 19, 1899.
H.R. Oct. 1, 1899.

2. *Larus philadelphia (Ord). Bonaparte's Gull (60).*
H.V.O. Oct. 17, 1900.
H.V.O. Nov. 2, 1900.
Sept. 19, 1896.

Order CUCULIFORMES

Family CUCULIDAE

1. *Coccyzus erythropthalmus (Wilson). Black-billed Cuckoo (388).*
   HVO. May 9, 1897.
   H.V.O. May 21, 1897.
   H.R. May 9, 1897.

Order STRIGIFORMES

Family STRIGIDAE

1. *Otus asio naevius (Gmelin). Eastern Screech Owl (373m).*
   H.V.O. Dec. 23, 1897.
   H.R. Dec. 10, 1897.
   H.R. Jan. 14, 1906.

2. *Bubo virginianus virginianus (Gmelin). Great Horned Owl (375).*
   H.V.O. Dec. 15, 1896.
   H.R. Jan. 11, 1898.

3. *Strix varia varia Barton. Northern Barred Owl (368).*
   E.C. Dec. 19, 1897.

4. *Asio wilsonianus (Lesson). Long-eared Owl (366).*
   H.R. Jan. 2, 1898.

5. *Asio flammeus flammeus (Pontoppidan), Short-eared Owl (367).*
   W.A.B. Nov. 1, 1896.

6. CRYPTOGLAUX *acadica acadica (Gmelin). Saw-whet Owl (372).*
   H.V.O. Nov. 19, 1897.

Order CAPRIMULGIFORMES

Family CAPRIMULGIDAE

1 *Chordeiles minor minor (Forster). Eastern Nighthawk (420).*
   H.R. May 22, 1898.

Order MICROPODIIFORMES

Family TROCHILIDAE

1. *Archilochus colubris (Linnaeus), Ruby-throated Humming-bird (428).*
   H.V.O. May 21, 1897.
   H.V.O. May 27, 1902.

Order PICIFORMES

Family PICIDAE

1. *Sphyrapicus varius varius (Linnaeus). Yellow-bellied Sapsucker (402).*
   H.V.O. Apr. 12, 1896.
   E.C. Apr. 18, 1897.
   H.V.O. Apr. 19, 1897.

2. *Dryobates pubescens medianus (Swainson). Northern Downy Woodpecker (394c).*
   H.V.O. Mar. 7, 1897.
   H.R. Apr. 11, 1897.

Order PASSERIFORMES

Family TYRANNIDAE

1. *Myiarchus crinitus boreus. Bangs. Northern Crested Flycatcher (452a).*
   H.V.O. May 14, 1899.
   H.R. May 17, 1896.

2. *Sayornis phoebe (Latham). Eastern Phoebe (456).*
   H.V.O. May 2, 1897.

3. *Empidonax flaviventris (Baird and Baird). Yellow-bellied Flycatcher (463).*
   H.V.O. Sept. 1896.

4. *Empidonax minimus (Baird and Baird). Least Flycatcher (467).*
   H.V.O. May 14, 1899.

Family ALAUDIDAE

1. *Otocoris alpestris alpestris (Linnaeus). Northern Horned Lark (474).*
   H.V.O. Mar. 26, 1899.

2. *Otocoris alpestris practicola. Henshaw. Prairie Horned Lark (474b).*
   H.V.O. Mar. 14, 1897.
   H.V.O. Jan. 30, 1898.
   H.V.O. Mar. 12, 1899.
   H.R. Mar. 7, 1897.
   H.R. Mar. 14, 1897.
   H.R. Jan. 30, 1898.
   H.R. Feb. 5, 1899.
   E.C. Jan. 30, 1898.

Family HIRUNDINIDAE

1. *Hirundo erythrogaster Boddaert. Barn Swallow (613).*
   H.V.O. May 14, 1899.

2. *Riparia riparia riparia (Linnaeus). Bank Swallow (616).*
   H.V.O. May 21, 1899.

Family CORVIDAE

1. *Cyanocitta cristata cristata (Linnaeus). Northern Blue Jay (477).*
   H.V.O. Apr. 25, 1897.

2. *Corvus brachyrhynchos brachyrhynchos Brehm. Eastern Crow (488).*
   H.V.O. June 6, 1897.

Family PARIDAE

1. *Penthestes atricapillus atricapillus (Linnaeus). Black-capped Chickadee (735).*
   H.V.O. Mar. 7, 1897.
   H.V.O. May 15, 1897.

Family SITTIDAE

1. *Sitta carolinensis carolinensis Latham. White-breasted Nuthatch (727).*
   H.R. Mar. 7, 1897.
   H. R. Dec. 26, 1897.
   H.R. Apr. 12, 1899.

Family CERTHIIDAE

1. *Certhia familiaris americana Bonaparte. Brown Creeper (726).*
   H.V.O. Apr. 11, 1897.
   H.R. Apr. 11, 1897.
   E.C. Feb. 4, 1900.

Family TROGLODYTIDAE

1. *Troglodytes domesticus baldwini.*[1] *House Wren.*
   E.C. May 6, 1897.
2. *Nannus hiemalis hiemalis (Vieillot). Eastern Winter Wren (722).*
   H.R. Oct. 6, 1897.
3. *Telmatodytes palustris dissaëptis (Bangs). Prairie Marsh Wren (725d).*
   E.C. May 17, 1896.
4. *Cistothorus stellaris (Naumann). Short-billed Marsh Wren (724).*
   E.C. May 6, 1897.

Family MIMIDAE

1. *Dumetella carolinensis (Linnaeus). Catbird (704).*
   H.V.O. May 10, 1897.

Family TURDIDAE

1. *Turdus migratorius migratorius Linnaeus. Eastern Robin (761).*
   H.V.O. June 14, 1897.
2. *Hylocichla mustelina (Gmelin). Wood Thrush (755).*
   H.V.O. Apr. 30, 1897.
3. *Hylocichla guttata faxoni Bangs and Penard. Eastern Hermit Thrush (759b).*
   H.R. Sept. 26, 1896.
4. *Hylocichla ustulata swainsoni (Tschudi). Olive-backed Thrush (758b).*
   H.V.O. May 19, 1897.
   H.R. Sept. 4, 1899.

[1] Not in the A. O. U. check-list.

5. *Hylocichla minima aliciae (Baird). Gray-cheeked Thrush (757).*
   H.R. Sept. 20, 1899.

6. *Hylocichla fucescens salicicola Ridgeway. Willow Thrush (756a).*
   H.R. May 14, 1899.

7. *Sialia sialis sialis (Linnaeus). Eastern Bluebird (766).*
   H.V.O. Apr. 11, 1897.

Family SILVIIDAE

1. *Polioptila caerulea caerulea (Linnaeus). Blue-gray gnatcatcher (751).*
   H.V.O. Apr. 25, 1897.

2. *Corthylio calendula calendula (Linnaeus). Eastern Ruby-crowned Kinglet (749).*
   H.V.O. Apr. 25, 1897.
   E.C. Apr. 18, 1897.

Family BOMBYCILLIDAE

1. *Bombycilla cedrorum Vieillot. Cedar Waxing (619).*
   H.V.O. May 30, 1897.

Family LANIIDAE

1. *Lanius borealis borealis Vieillot. Northern Shrike (621).*
   H.VO. Nov. 21, 1897.

Family VIREONIDAE

1. *Vireo flavifrons Vieillot. Yellow-throated Vireo (628).*
   H.V.O. May 9, 1897.
   H.V.O. May 15, 1897.

2. *Vireo olivaceus (Linnaeus). Red-eyed Vireo (624).*
   H.V.O. May 9, 1897.
   H.R. Sept. 1896.

3. *Vireo gilvus gilvus (Vieillot). Eastern Warbling Vireo (627).*
   H.V.O. May 17, 1896.

Family COMPSOTHLYPIDAE

1. *Mniotilta varia (Linnaeus). Black and White Warbler (636).*
   H.V.O. May 16, 1897.

2. *Vermivora peregrina (Wilson). Tennessee Warbler (647).*
   H.V.O. May 15, 1897.

3. *Vermivora ruficapilla ruficapilla (Wilson). Nashville Warbler (645).*
   H.V.O. May 14, 1897.

4. *Dendroica magnolia (Wilson). Magnolia Warbler (657).*
   H.V.O. May 17, 1897.
   H.V.O. May 15, 1898.
   H.R. May 9, 1897.
   E.C. May 9, 1897.

5. *Dendroica tigrina (Gmelin). Cape May Warbler (650).*
   H.V.O. May 14, 1897.
   H.V.O. May 15, 1897.
   H.V.O. May 16, 1897.

6. *Dendroica caerulescens caerulescens (Gmelin). Black-throated Blue Warbler (654).*
   H.R. May 10, 1896.

7. *Dendroica Coronata (Linnaeus). Myrtle Warbler (655).*
   H.V.O. Apr. 25, 1897.
   H.R. Apr. 18, 1897.
   E.C. Apr. 18, 1897.

8. *Dendroica virens virens (Gmelin). Black-throated Green Warbler (667).*
   H.V.O. May 16, 1897.
   E.C. May 14, 1899.

9. *Dendroica fusca (Müller). Blackburnian Warbler (662).*
   H.V.O. May 9, 1897.
   H.V.O. May 17, 1897.
   H.V.O. May 20, 1897.
   H.R. May 17, 1897.

10. *Dendroica pennsylvanica (Linnaeus). Chestnut-sided Warbler (659).*
    H.V.O. May 17, 1897.
    H.R. May 9, 1897.
    E.C. May 17, 1897.

11. *Dendroica castanea (Wilson). Bay-breasted Warbler (660).*
    H.V.O. May 10, 1896.
    H.R. Sept. 10, 1899.
    E.C. May 16, 1897.
    E.C. May 17, 1897.

12. *Dendroica striata (Forster). Black-poll Warbler (661).*
    H.V.O. May 18, 1897.
    H.V.O. May 19, 1897.
    E.C. May 16, 1897.

13. *Dendroica pinus pinus (Wilson). Northern Pine Warbler (671).*
    H.V.O. Apr. 25, 1897.
    H.V.O. May 2, 1897.
    H.R. May 15, 1896.

14. *Dendroica palmarum palmarum (Gmelin). Western Palm Warbler (672).*
    H.V.O. May 6, 1897.

15. *Seiurus aurocapillus (Linnaeus). Ovenbird (674).*
    H.V.O. May 3, 1896.
    H.V.O. May 10, 1897.
    H.R. May 6, 1897.

16. *Seiurus noveboracensis noveboracensis (Gmelin). Northern Water Thrush (675).*
H.V.O. May 2, 1897.

17. *Seiurus motacilla (Vieillot). Louisiana Water Thrush (676).*
H.R. Apr. 25, 1897.

18. *Oporonis agilis (Wilson). Connecticut Warbler (678).*
H.R. Apr. 25, 1897.
H.V.O. May 31, 1897.

19. *Geothlypic trichas brachidactyla (Swainson). Northern Yellow-throat (681d).*
H.V.O. May 9, 1897.
H.V.O. May 12, 1899.
H.R. Sept. 1896.
H.R. May 9, 1897.

20. *Wilsonia canadensis (Linnaeus). Canada Warbler (686).*
H.V.O. May 20, 1897.
H.V.O. May 21, 1897.
H.R. Sept. 1896.
E.C. May 9, 1897.
E.C. May 17, 1896.

21. *Setophaga ruticilla (Linnaeus). American Redstart (687).*
H.V.O. May 15, 1897.
H.V.O. May 18, 1897.

Family PLOCEIDAE

1. *Passer domesticus domesticus (Linnaeus). English Sparrow (688.2).*
H.R. June, 1899.

Family ICTERIDAE

1. *Dolichonyx oryzivorus (Linnaeus). Bobolink (494).*
H.R. May 9, 1897.
H.R. May 14, 1899.

2. *Sturnella magna magna (Linnaeus). Eastern Meadowlark (501).*
H.V.O. Apr. 26, 1896.

3. *Xanthocephalus xanthocephalus (Bonaparte). Yellow-headed Blackbird (497).*
H.V.O. May 5, 1901.

4. *Agelaius phoeniceus phoeniceus (Linnaeus). Eastern Red-wing (498).*
H.R. May 19, 1897.

5. *Icterus galbula (Linnaeus). Baltimore Oriole (507).*
H.V.O. May 15, 1897.

6. *Quiscalus quiscula aeneus. Ridgeway. Bronzed Crackle (511b).*
H.V.O. Apr. 18, 1897.

7. *Molothrus ater ater (Boddaert). Eastern Cowbird (495).*
H.V.O. May 7, 1897.

Family THRAUPIDAE

1. *Piranga erythromelas Vieillot. Scarlet Tanager (608).*
H.V.O. May 18, 1897.
H.R. May 2, 1897.

Family FRINGILLIDAE

1. *Hedymeles ludovisianus (Linnaeus). Rose-breasted Grosbeak. (595).*
H.V.O. May 15, 1897.
H.V.O. May 19, 1897.
H.R. May 10, 1896.

2. *Passerina cyanea (Linnaeus). Indigo Bunting (598).*
H.V.O. May 18, 1897.

3. *Hesperiphona vespertina vespertina (Cooper). Eastern Evening Grosbeak (514).*
H.R. Feb. 18, 1900.
E.C. Feb. 18, 1900.
E.C. Mar. 11, 1900.

4. *Carpodacus purpureus purpureus (Gmelin). Eastern Purple Finch (517).*
H.R. Apr. 18, 1897.

5. *Pinicola enucleator leucura (Müller). Canadian Pine Grosbeak (515).*
H.V.O. Apr. 8, 1900.

6. *Acanthis linaria linaria (Linnaeus). Common Redpoll (528).*
H.V.O. Oct. 29, 1899.
H.R. Oct. 29, 1899.
H.R. Nov. 26, 1899.
H.R. Dec. 12, 1899.

7. *Spinus pinus pinus (Wilson). Northern Pine Siskin (533).*
H.V.O. Nov. 15, 1896.
H.R. Oct. 29, 1899.

8. *Loxia curvirostra pusilla Gloger. Red Crossbill (521).*
H.V.O. Nov. 13, 1898.
H.R. Feb. 19, 1899.
H.R. Apr. 2, 1899.

9. *Loxia leucoptera Gmelin. White-winged Crossbill (522).*
H.V.O. Feb. 4, 1900.
H.R. Oct. 29, 1899.
H.R. Feb. 4, 1900.

10. *Pipilo erythropthalmus erythropthalmus (Linnaeus). Red-eyed Towhee (587).*
H.V.O. Apr. 25, 1897.
H.R. Apr. 25, 1897.

11. *Passerculus sandwichensis savanna (Wilson). Eastern Savanna Sparrow (542a).*
H.V.O. May 6, 1897.
H.R. Sept. 1896.
E.C.

12. *Pooecetes gramineus gramineus (Gmelin). Eastern Vesper Sparrow (540).*
H.V.O. Apr. 11, 1897.
H.R. Apr. 11, 1897.

13. *Chondestes grammacus grammacus (Say). Eastern Lark Sparrow (552).*
H.V.O. May 15, 1898.

14. *Junco hyemalis hyemalis (Linnaeus). Slate-colored Junco (567).*
E.C. Nov. 15, 1896.

15. *Spizella arborea arborea (Wilson). Eastern Tree-sparrow (559).*
H.V.O. Nov. 15, 1896.
H.R. Nov. 15, 1896.
H.R. Apr. 12, 1899.

16. *Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow (554).*
H.V.O. May 2, 1897.

17. *Zonotrichia albicollis (Gmelin). White-throated Sparrow (558).*
H.V.O. Apr. 18, 1897.
H.R. Oct. 6, 1897.

18. *Melospiza lincolni lincolni (Audubon). Lincoln's Sparrow (583).*
H.R. Sept. 20, 1899.

19. *Melospiza georgiana (Latham). Swamp Sparrow (584).*
H.V.O. May 7, 1897.

20. *Melospiza melodia beata Bangs. Mississippi Song Sparrow (581).*
H.V.O. Mar. 21, 1897.
H.R. Mar. 28, 1897.

21. *Calcarius lapponicus lapponicus (Linnaeus). Lapland Longspur (536).*
H.V.O. Jan. 30, 1898.
H.V.O. Mar. 12, 1899.
H.R. Dec. 26, 1897.
H.R. Nov. 26, 1899.

22. *Plectrophenax nivalis nivalis (Linnaeus). Eastern Snow-bunting (534).*
H.V.O. Mar. 11, 1900.
H.R. Mar. 11, 1900.

APPENDIX I

JEFFERSON AND WALWORTH COUNTIES

(Counties adjoining those of Group I, but farther inland)

Order PASSERIFORMES

Family COMPSOTHLYPIDAE

1. *Seiurus noveboracensis noveboracensis (Gmelin). Northern Water Thrush (675).*
L.K. May 15, 1898.

2. *Seiurus noveboracensis notabilis Ridgway. Grindell's Water Thrush (675a).*
L.K. May 15, 1898.

Family FRINGILLIDAE

1. *Passerherbulus henslowi henslowi (Audubon). Western Henslowe's Sparrow (547a).*
N.H. May 25, 1902.

2. *Ammospiza caudacuta nelsoni (Allen). Nelson's Sparrow (549.1).*
L.K. Sept. 5, 1898.
L.K. Sept. 16, 1898.

II. GREEN COUNTY

Order CHARADRIIFORMES

Family SCOLOPACIDAE

1. *Bartramia longicauda (Bechstein). Upland Plover (261).*
E.C. May 29, 1876.

OrderPASSERIFORMES

Family TYRANNIDAE

1. *Empidonax minimus (Baird and Baird). Least Flycatcher (467).*
Aug. 23, 1876.

Family COMPOSOTHLYPIDAE

1. *Mniotilta varia (Linnaeus). Black and White Warbler (636).*
E.C. May 30, 1876.

2. *Oporornis agilis (Wilson). Connecticut Warbler (678).*
E.C. June, 1876.

Family ICTERIDAE

1. *Dolichonyx oryzivorus (Linnaeus). Bobolink (494).*
E.C. 1876.

Family THRAUPIDAE

1. *Piranga erythromelas. Vieillot. Scarlet Tanager (608).*
   E.C. 1876.

III. VILAS AND IRON COUNTIES

Order GAVIIFORMES

Family GAVIIDAE

1. *Gavia immer elasson Bishop. Lesser Loon (7a).*
   H.B.H. Sept. 1900.

Order ANSERIFORMES

Family ANATIDAE

1. *Melanitta perspicillata (Linnaeus). Surf Scoter (166).*
   Oct. 6, 1898.
   Oct. 7, 1898.

Order GALLIFORMES

Family TETRAONIDAE

1. *Canachites canadensis canace (Linnaeus). Canada Spruce Grouse (298c).*
   Oct. 14, 1898.

2. *Bonasa umbellus togata (Linnaeus). Canada Ruffed Grouse (300a).*
   Sept. 29, 1898.

Order GRUIFORMES

Family RALLIDAE

1. *Fulica americana americana (Gmelin). American Coot (221).*
   Sept. 24, 1898.

Order STRIGIFORMES

Family STRIGIDAE

1. *Bubo virginianus virginianus (Gmelin). Great Horned Owl (375).*
   H.V.O. Jan. 20, 1896.

2. *Strix varia varia Barton. Northern Barred Owl (368).*
   H.V.O. Sept. 28, 1903.

3. *Cryptoglaux acadica acadica (Gmelin). Saw-whet Owl (372).*
   H.R. Mar. 13, 1899.

Order PICIFORMES

Family PICIDAE

1. *Coephloeus pileatus abieticola. Bangs. Northern Pileated Woodpecker (405a).*
   Sept. 23, 1898.
   Sept. 25, 1898.

2. *Picoides arcticus (Swainson). Artic Three-toed Woodpecker (400).*
Sept. 25, 1898.
Sept. 30, 1898.
Oct. 4, 1898.

3. *Picoides tridactylus bacatus. Bangs. American Three-toed Woodpecker (401).*
Sept. 23, 1898.
Sept. 30, 1898.

Order PASSERIFORMES

Family MOTACILLIDAE

1. *Anthus spinoletta rubescens (Tunstall). American Pipit (697).*
Oct. 10, 1898.

Family VIREONIDAE

1. *Vireo solitarius solitarius (Wilson). Blue-headed Vireo (629).*
Sept. 24, 1898.

Family COMPSOTHYLYPIDAE

1. *Vermivora peregrina (Wilson). Tennessee Warbler (647).*
Sept. 22, 1898.
Sept. 23, 1898.

2. *Dendroica caerulescens caerulescens (Gmelin). Black-throated Blue Warbler (654).*
Sept. 19, 1896.

3. *Dendroica virens virens(Gmelin). Black-throated Green Warbler (667).*
Sept. 22, 1898.
Sept. 23, 1898.

4. *Dendroica castanea (Wilson). Bay-breasted Warbler (660).*
Sept. 21, 1898.
Sept. 22, 1898.

5. *Dendroica striata (Forster). Black-poll Warbler (661).*
Sept. 19, 1898.
Sept. 22, 1898.

6. *Seiurus aurocapillus (Linnaeus). Ovenbird (674).*
Sept. 22, 1898.

7. *Seiurus noveboracensis noveboracensis (Gmelin). Northern Water Thrush (675).*
Sept. 18, 1898.

Family FRINGILLIDAE

1. *Carpodacus purpureus purpureus (Gmelin). Eastern Purple Finch (517).*
Oct. 11, 1898.

2. *Pinicola enucleator leucura (Müller). Canadian Pine Grosbeak (515).*
   Sept. 23, 1898.
   Oct. 4, 1898.

3. *Loxia curvirostra pusilla. Gloger. Red Crossbill (521).*
   Sept. 20, 1898.
   Oct. 3, 1898.

4. *Junco hyemalis hyemalis (Linnaeus). Slate-colored Junco (567).*
   Oct. 6, 1898.

5. *Zonotrichia querula (Nuttall). Harris's Sparrow (553).*
   Oct. 6, 1898.

6. *Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow (554).*
   Sept. 29, 1898.

7. *Passerella iliaca iliaca (Merrem). Eastern Fox Sparrow (585).*
   Oct. 6, 1898.

8. *Melospiza melodia beata Bangs. Mississippi Song Sparrow (581).*
   Sept. 24, 1898.

APPENDIX to III.

DOUGLAS COUNTY

(In approximately the same region as those of Group III, but farther west).

Order GALLIFORMES

Family TETRAONIDAE

1. *Canachites canadensis canace (Linnaeus). Canada Spruce Partridge (298c).*
   H.V.O. Oct. 9, 1902.

2. *Pedioecetes phasianellus campeatris Ridgway. Prairie Sharp-tailed Grouse (308b).*
   H.V.O. Oct. 6, 1902.
   H.V.O. Oct. 7, 1902.

BIRDS OF NORTHERN AND WESTERN STATES
I. MINNESOTA

ITASCA AND ST. LOUIS COUNTIES

Order COLYMBIFORMES

Family COLYMBIDAE

1. *Podilymbus podiceps podiceps (Linnaeus). Pied-billed Grebe (6).*
   H.V.O. Oct. 6, 1897.

Order ANSERIFORMES

Family ANATIDAE

1. *Anas platyrhynchos platyrhynchos. Linnaeus. Common Mallard (132).*
   E.C. Oct. 11, 1897.

2. *Querquedula discors (Linnaeus). Blue-winged Teal (140).*
   H.V.O. Oct. 3, 1897.

3. *Nyroca americana (Eyton). Redhead (146).*
   H.V.O. Oct. 6, 1897.

4. *Nyroca collaris (Donovan). Ring-necked Duck (150).*
   H.V.O. Sept. 27, 1897.

5. *Charitonetta albeola (Linnaeus). Bufflehead (153).*
   E.C. Oct. 7, 1897.

Order FALCONIFORMES

Family CATHARTIDAE

1. *Cathartes aura septentrionalis. Wied. Turkey Vulture (325).*
   E.C. Oct. 6, 1897.

Family ACCIPITRIDAE

1. *Accipiter velox velox (Wilson). Sharp-shinned Hawk (332).*
   H.V.O. Sept. 20, 1896.

2. *Buteo platypterus platypterus (Vieillot). Broad-winged Hawk (343).*
   E.C. Sept. 18, 1897.

3. *Haliaeetus leucocephalus leucocephalus (Linnaeus). Southern Bald Eagle (352).*
   E.C. Sept. 23, 1896.

4. *Circus hudsonius (Linnaeus). Marsh Hawk (331).*
   E.C. Sept. 20, 1896.

Family FALCONIDAE

1. *Falco columbarius columbarius (Linnaeus). Eastern Pigeon Hawk (375).*
   H.V.O. Sept. 18, 1896.
   E.C. Sept. 25, 1897.

Order GALLIFORMES

Family TETRAONIDAE

1. *Bonasa umbellus togata (Linnaeus). Canada Ruffed Grouse (300a).*
   E.C. Sept. 26, 1897.
   E.C. Sept. 29, 1897.
   E.C. Oct. 2, 1897.

Order CHARADRIIFORMES

Family SCOLOPACIDAE

1. *Cappella delicata (Ord). Wilson's Snipe (230).*
   E.C. Oct. 4, 1897.

2. *Actitis macularia (Linnaeus). Spotted Sandpiper (263).*
   H.V.O. Sept. 28, 1896.
   H.V.O. Oct. 6, 1896.
   E.C. Sept. 28, 1896.

3. *Tringa solitaria solitaria Wilson. Eastern Solitary Sandpiper (256).*
   H.V.O. Sept. 24, 1897.
   E.C., Oct. 6, 1897.

4. *Pisobia melanotos (Vieillot). Pectoral Sandpiper (239).*
   H.V.O. Sept. 22, 1897.

Order STRIGIFORMES

Family STRIGIDAE

1. *Bubo virginianus subarcticus Hoy. Arctic Horned Owl (375b).*
   H.V.O. Feb. 1898.

2. *Bubo virginianus virginianus (Gmelin). Great Horned Owl (375).*
   H.V.O. Sept. 25, 1896.

3. *Surnia ulula caparoch (Müller). American Hawk Owl (377a).*
   J.H.V.W. Nov. 1903.

4. *Scotiaptex nebulosa nebulosa (Forster). Great Gray Owl (370).*
   H.V.O. Feb. 1897.
   E.C., Feb. 1898.

Order CORACIIFORMES

Family ALCEDINIDAE

1. *Megaceryle alcyon alcyon (Linnaeus). Eastern Belted Kingfisher (390).*
   E.C. Sept. 30, 1897.

Order PICIFORMES

Family PICIDAE

1. *Colaptes auratus luteus Bangs. Northern Flicker (412a).*
   H.V.O. Sept. 30, 1896.

2. *Dryobates villosus villosus (Linnaeus). Eastern Hairy Woodpecker (393).*
   H.V.O. Oct. 4, 1896.
   E.C. Oct. 3, 1897.

3. *Picoides arcticus (Swainson). Arctic Three-toed Woodpecker (400).*
   H.V.O. Oct. 14, 1896.
   E.C. Oct. 15, 1896.

4. *Picoides tridactylus bacatus Bangs. American Three-toed Woodpecker (401).*
E.C. Oct. 2, 1896.

Order PASSERIFORMES

Family TYRANNIDAE

1. *Myiochanes virens (Linnaeus). Eastern Wood Pewee (461).*
H.V.O. Sept. 21, 1897.

Family ALAUDIDAE

1. *Otocoris alpestris hoyti Bishop. Hoyt's Horned Lark (474k).*
H.V.O. Sept. 17, 1896.
E.C. Oct. 2, 1897.

Family CORVIDAE

1. *Perisorius canadensis canadensis (Linnaeus). Canada Jay (484).*
H.V.O. Oct. 1, 1896.
H.V.O. Oct. 12, 1897.
E.C. Sept. 26, 1896.
E.C. Oct. 2, 1896.

Family PARIDAE

1. *Penthestes atricapillus atricapillus (Linnaeus). Black-caped Chickadee (735).*
E.C. Oct. 5, 1897.

2. *Penthestes hudsonicus hudsonicus (Forster). Hudsonian Chickadee (740).*
E.C. Oct. 8, 1897.

Family SITTIDAE

1. *Sitta carolinensis carolinensis Latham. White-breasted Nuthatch (727).*
H.V.O. Oct. 1, 1896.

2. *Sitta canadensis Linnaeus. Red-breasted Nuthatch (728).*
E.C. Oct. 5, 1897.

Family LANIIDAE

1. *Lanius borealis borealis (Vieillot). Northern Shrike (621).*
E.C. Oct. 3, 1896.

Family VIREONIDAE

1. *Vireo solitarius solitarius (Wilson). Blue-headed Vireo (629).*
E.C. Sept. 26, 1897.

Family COMPSOTHLYPIDAE

1. *Vermivora celata celata (Say). Orange-crowned Warbler (646).*
H.V.O. Sept. 20, 1897.
H.V.O. Sept. 22, 1897.
E.C. Sept. 21, 1897.

2. *Vermivora ruficapilla ruficapilla (Wilson). Nashville Warbler (456).*
   E.C. Sept. 21, 1897.
   E.C. Oct. 6, 1897.

3. *Dendroica pinus pinus (Wilson). Northern Pine Warbler (671).*
   H.V.O. Sept. 21, 1897.
   E.C. Sept. 21, 1897.

4. *Dendroica palmarum palmarum (Gmelin). Western Palm Warbler (672).*
   H.V.O. Oct. 6, 1896.
   H.V.O. Sept. 21, 1897.
   E.C. Oct. 1, 1897.

Family ICTERIDAE

1. *Euphagus carolinus (Müller). Rusty Blackbird (509).*
   H.V.O. Sept. 22, 1888.
   H.V.O. Sept. 24, 1897.
   H.V.O. Oct. 1, 1897.

Family FRINGILLIDAE

1. *Hesperiphona vespertina vespertina (Cooper). Eastern Evening Grosbeak (514).*
   H.V.O. Oct. 6, 1896.
   E.C. Oct. 6, 1896.

2. *Carpodacus purpureus purpureus (Gmelin). Eastern Purple Finch (517).*
   E.C. Sept. 24, 1897.
   E.C. Sept. 30, 1896.
   E.C. Oct. 10, 1897.

3. *Spinus tristis tristis (Linnaeus). Eastern Goldfinch (529).*
   H.V.O. Sept. 26, 1897.

4. *Loxia curvirostra pusilla Gloger. Red Crossbill (521).*
   H.V.O. Oct. 4, 1897.
   E.C. Oct. 4, 1897.

5. *Loxia leucoptera Gmelin. White-winged Crossbill (522).*
   H.V.O. Sept. 25, 1897.
   H.V.O. Sept. 26, 1897.
   E.C. Sept. 25, 1897.

6. *Junco hyemalis hyemalis (Linnaeus). Slate-colored Junco (567).*
   H.V.O. Sept. 26, 1896.
   E.C. Oct. 3, 1897.
   E.C. Oct. 4, 1897.

7. *Spizella arborea arborea (Wilson). Eastern Tree Sparrow (559).*
   H.V.O. Oct. 4, 1897.
   E.C. Oct. 6, 1897.
   E.C. Oct. 9, 1896.

8. *Zonotrichia querula (Nuttall). Harris's Sparrow (553).*
H.V.O. Sept. 18, 1897.
H.V.O. Sept. 24, 1897.
H.V.O. Sept. 26, 1897.
E.C. Sept. 26, 1897.

9. *Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow (554).*
E.C. Sept. 26, 1897.

10. *Zonotrichia albicollis (Gmelin). White-throated Sparrow (558).*
H.V.O. Oct. 2, 1897.
E. C. Oct. 4, 1897.

11. *Passerella iliaca iliaca (Merrem). Eastern Fox Sparrow (585).*
H.V.O. Oct. 5, 1897.
E.C. Oct. 2, 1897.

12. *Melospiza lincolni lincolni (Audubon). Lincoln's Sparrow.*
E.C. Sept. 16, 1896.

13. *Melospiza georgiana (Latham). Swamp Sparrow (584).*
H.V.O. Sept. 18, 1896.
E.C. Sept. 17, 1896.

14. *Calcarius lapponicus lapponicus (Linnaeus). Lapland Longspur (536).*
H.V.O. Oct. 9, 1896.
H.V.O. Oct. 12, 1897.
E.C. Sept. 25, 1897.
E.C. Sept. 26, 1897.

15. *Plectrophenax nivalis nivalis (Linnaeus). Eastern Snow Bunting (534).*
H.V.O. Oct. 11, 1896.

II. NORTH DAKOTA

FOSTER AND WELLS COUNTIES

Order ANSERIFORMES

Family ANATIDAE

1. *Chen coerulescens (Linnaeus). Blue Goose (169.1).*
H.V.O. Oct. 1897.

2. *Chaulelasmus streperus (Linnaeus). Gadwall (135).*
E.C.

3. *Nyroca americana (Eyton). Redhead (146).*
E.C. Oct. 4, 1899.

4. *Charitonetta albeola (Linnaeus). Bufflehead (153).*
E.C. Oct. 3, 1899.

5. *Lophodytes cucullatus (Linnaeus). Hooded Merganser (131).*
E.C. Oct. 9, 1899.

Order FALCONIFORMES

Family ACCIPITRIIDAE

1. *Accipiter velox (Wilson). Sharp-shinned Hawk (332).*
E.C. Oct. 8, 1899.

2. *Buteo borealis krideri Hoopes. Krider's Hawk (337a.)*
E.C. Oct. 7, 1899.

3. *Buteo regalis (Gray). Ferruginous Rough-leg (348).*
H.V.O. Sept. 25, 1899.

4. *Circus hudsonius (Linnaeus). Marsh Hawk (331).*
H.V.O. Oct. 5, 1899.
H.V.O. Oct. 8, 1899.

Family FALCONIDAE

1. *Falco perigrinus anatum Bonaparte. Duck Hawk. (356a).*
H.V.O. Sept. 23, 1899.

2. *Falco columbarius columbarius (Linnaeus). Eastern Pigeon Hawk (357).*
E.C.

Order GALLIFORMES

Family TETRAONIDAE

1. *Tympanuchus cupido americanus (Reichenbach). Greater Prairie Chicken (305).*
H.V.O. Sept. 25, 1899.

Order CHARADRIIFORMES

Family CHARADRIIDAE

1. *Charadrius semipalmatus. Bonaparte. Semipalmated Plover (274).*
E.C. Sept. 28, 1889.

2. *Pluvialis dominica dominica (Müller). American Golden Plover (272).*
H.V.O. Sept. 28, 1899.

3. *Squatarola squatarola (Linnaeus). Black-bellied Plover (270).*
H.V.O. Sept. 28, 1899.
H.V. O. Oct. 1, 1899.

Family SCOLOPACIDAE

1. *Totanus melanoleucus (Gmelin). Greater Yellowlegs (254).*
H.V.O. Sept. 21, 1899.

2. *Totanus flavipes (Gmelin). Lesser Yellowlegs (255).*
H.V.O. Sept. 21, 1899.

3. *Pisobia melanotos (Vieillot). Pectoral Sandpiper (239).*
H.V.O. Oct. 3, 1899.

4. *Pisobia bairdi (Coues). Baird's Sandpiper (241).*
H.V.O. Sept. 27, 1899.
H.V.O. Sept. 22, 1899.

5. *Pisobia minutilla (Vieillot). Least Sandpiper (242).*
H.V.O. Sept. 22, 1899.
E.C. Oct. 1, 1899.

6. *Limnodromus griseus griseus hendersoni. Dowitcher.*
H.V.O. Sept. 22, 1899.

7. *Limnodromus griseus scolopaceus (Say). Long-billed Dowitcher (232).*
H.V.O. Sept. 28, 1899.

Family PHALAROPODIDAE

1. *Lobipes lobatus (Linnaeus). Northern Phalerope (223).*
H.V.O. Sept. 26, 1899.
H.V.O. Sept. 27, 1899.

Order STRIGIFORMES

Family STRIGIDAE

1. *Bubo virginianus subarcticus (Hoy). Arctic Horned Owl (375b).*
E.C. Oct. 8, 1899.

2. *Speotyto cunicularia hypugaea (Ridgway). Western Burrowing Owl (378a).*
E.C.

Order PASSERIFORMES

Family ALAUDIDAE

1. *Otocoris alpestris enthymia Oberholser. Saskatchewan Horned Lark.*
H.V.O. Sept. 24, 1899.

Family LANIIDAE

1. *Lanius borealis borealis Vieillot. Northern Shrike (621).*
E.C. Oct. 5, 1899.

Family COMPSOTHLYPIDAE

1. *Geothlypis trichas brachidactyla (Swainson). Northern Yellow-throat (681d).*
H.V.O. Sept. 26, 1899.

Family ICTERIDAE

1. *Sturnella neglecta Audubon. Western Meadowlark (501.1).*
H.V.O. Sept. 29, 1899.

2. *Euphagus carolinus (Müller). Rusty Blackbird (509).*
H.V.O. Sept. 22, 1888.

3. *Euphagus cyanocephalus (Wagler). Brewer's Blackbird (510).*
H.V.O. Oct. 1, 1899.

Family FRINGILLIDAE

1. *Zonotrichia leucophrys leucophrys (Forster). White-crowned Sparrow (554).* *H.V.O. Sept. 23, 1899.*

2. *Calcarius lapponicus lapponicus (Linnaeus). Lapland Longspur (536).*
H.V.O. Sept. 24, 1899.

III. WYOMING

UINTA COUNTY

Order PELECANIFORMES

Family PELICANIDAE

1. *Pelecanus erythrorhynchos Gmelin. White Pelican (125).*
H.V.O. Sept. 10, 1900.

Order GALLIFORMES

Family TETRAONIDAE

1. *Dendragapus obscurus richardsoni (Douglas). Richardson's Grouse. (297b).*
H.V.O. Sept. 14, 1900.

Order PASSERIFORMES

Family CORVIDAE

1. *Perisorius canadensis capitalis Ridgway. Rocky Mountain Jay (484a).*
H.V.O. Sept. 1900.

2. *Cyanocitta stelleri annectens (Baird). Black-headed Jay (478c).*
H.V.O. Sept. 15, 1900.

3. *Nucifraga columbiana (Wilson). Clark's Nutcracker (491).*
H.V.O. Sept. 15, 1900.

Family CINCLIDAE

1. *Cinclus mexicanus unicolor Bonaparte. Dipper (701).*
H.V.O. Sept. 19, 1900.

BIRDS OF CENTRAL AND SOUTHERN STATES

I. INDIANA

MARION COUNTY

Order PICIFORMES

Family PICIDAE

1. *Colaptes auratus luteus Bangs. Northern Flicker (412a).*
E.C. Feb. 1876.

2. *Centurus carolinus (Linnaeus). Red-bellied Woodpecker (409).*
E.C. Feb. 1876.

3. *Melanerpes erythrocephalus (Linnaeus). Red-headed Woodpecker* (406).
E.C. Feb. 1876.

4. *Sphyrapicus varius varius (Linnaeus). Yellow-bellied Sapsucker (402).*
E.C. Apr. 19, 1876.

5. *Dryobates pubescens medianus (Swainson). Northern Downy Woodpecker (394c).*
E.C. Feb. 1876.

Order PASSERIFORMES

Family ALAUDIDAE

1. *Octocoris alpestris hoyti Bishop.*[1] *Hoyt's Horned Lark (474k).*
E.C. Mar. 20, 1876.

Family CORVIDAE

1. *Cyanocitta cristata cristata (Linnaeus). Northern Blue Jay (477).*
E.C. Feb. 1876.

Family PARIDAE

1. *Penthestes atricapillus atricapillus (Linnaeus). Black-capped Chickadee (735).*
E.C. Spring, 1876.

2. *Baeolophus bicolor (Linnaeus). Tufted Titmouse (731).*
E.C. Feb. 1876.

Family CERTHIIDAE

1. *Certhia familiaris americana Bonaparte. Brown Creeper (726).*
E.C. Feb. 1876.

Family TROGLODYTIDAE

1. *Troglodytes domesticus baldwini. House Wren.*
E.C. Spring, 1876.

2. *Nannus hiemalis hiemalis (Vieillot). Eastern Winter Wren (722).*
E.C. Apr. 3, 1876.

3. *Thryothorus ludovicianus ludovicianus (Latham). Carolina Wren (718).*
E.C. Spring, 1876.

Family MIMIDAE

1. *Dumetella carolinensis (Linnaeus). Catbird (704).*
E.C. Spring, 1876.

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[1] Dr. Oberholser thinks this is the first certain record of Hoyt's Horned Lark for Indiana.

2. *Toxostoma rufum (Linnaeus). Brown Thrasher (705).*
E.C. Apr. 4, 1877.

Family TURDIDAE

1. *Sialia sialis sialis (Linnaeus). Eastern Bluebird (766).*
E.C. Feb. 1876.

Family SILVIIDAE

1. *Polioptila caerulea caerulea (Linnaeus). Blue-gray Gnatcatcher (751).*
E.C. Apr. 17, 1876.
E.C. Spring, 1876.

2. *Regulus satrapa satrapa Lichtenstein. Eastern Golden-crowned Kinglet (748).*
E.C. Apr. 3, 1876.
E.C. Apr. 4, 1876.

3. *Corthylio calendula calendula (Linnaeus). Eastern Ruby-crowned Kinglet (749).*
E.C. Apr. 19, 1876.

Family VIREONIDAE

1. *Vireo olivaceus (Linnaeus). Red-eyed Vireo (624).*
E.C. Apr. 17, 1876.

Family COMPSOTHLYPIDAE

1. *Helmitheros vermivorus (Gmelin). Worm-eating Warbler (639).*
E.C. Spring, 1876.

2. *Vermivora pinus (Linnaeus). Blue-winged Warbler (641).*
E.C. Spring, 1876.

3. *Compsothlypis americana pusilla (Wilson). Northern Parula Warbler (648a).*
E.C. Spring, 1876.

4. *Dendroica aestiva aestiva (Gmelin). Eastern Yellow Warbler (652).*
E.C. Spring, 1876.

5. *Dendroica magnolia (Wilson). Magnolia Warbler (657).*
E.C. Spring, 1876.

6. *Dendroica tigrina (Gmelin). Cape May Warbler (650).*
E.C. Spring, 1876.

7. *Dendroica coronata (Linnaeus). Myrtle Warbler (655).*
E.C. Spring, 1876.

8. *Dendroica virens virens (Gmelin). Black-throated Green Warbler (667).*
E.C. Spring, 1876.

9. *Dendroica cerulea (Wilson). Cerulean Warbler (658).*
E.C. Spring, 1876.

10. *Dendroica fusca (Müller). Blackburnian Warbler (662).*
E.C. Spring, 1876.

11. *Dendroica dominica albilora Ridgway. Sycamore Warbler (663a).*
E.C. Spring, 1876.

12. *Dendroica pennsylvanica (Linnaeus). Chestnut-sided Warbler (659).*
E.C. Spring, 1876.

13. *Dendroica striata (Forster). Black-poll Warbler (661).*
E.C. Spring, 1876.

14. *Dendroica palmarum palmarum (Gmelin). Western Palm Warbler (672).*
E.C. Spring, 1876.

15. *Seiurus noveboracensis noveboracensis (Gmelin). Northern Water Thrush (675).*
E.C. Spring, 1876.

16. *Wilsonia canadensis (Linnaeus). Canada Warbler (686).*
E.C. Spring, 1876.

17. *Setophaga ruticella (Linnaeus). American Redstart (687).*
E.C. Spring, 1876.

Family THRAUPIDAE

1. *Piranga erythromelas (Vieillot). Scarlet Tanager*
E.C. Spring, 1876.

Family FRINGILLIDAE

1. *Richmondena cardinalis cardinalis (Linnaeus). Eastern Cardinal (593).*
E.C. Spring, 1876.

2. *Spinus tristis tristis (Linnaeus). Eastern Goldfinch (529).*
E.C. Apr. 4, 1876.

3. *Pipilo erythropthalmus erythropthalmus (Linnaeus). Red-eyed Towhee (587).*
E.C. Mar. 18, 1876.

4. *Pooecetes gramineus gramineus (Gmelin). Eastern Vesper Sparrow* (540).
E.C. Apr. 19, 1876.

5. *Chondestes grammacus grammacus (Say). Eastern Lark Sparrow (552).*
E.C. Oct. 6, 1877.

6. *Junco hyemalis hyemalis (Linnaeus). Slate-colored Junco (567).*
E.C. Mar. 18, 1876.

7. *Spizella arborea arborea (Wilson). Eastern Tree-sparrow (559).*
E.C. Mar. 18, 1876.

8. *Passerella iliaca iliaca (Merrem). Eastern Fox Sparrow (585).*
E.C. Mar. 30, 1876.

II. KENTUCKY

LEE COUNTY

Order PASSERIFORMES

Family ICTERIDAE

1. *Quiscalus quiscula aeneus Ridgway. Bronzed Grackle (511b).*
C.J.A. Nov. 15, 1900.

BIRDS OF MISCELLANEOUS LOCALITIES

I. ONTARIO

Order ANSERIFORMES

Family ANATIDAE

1. *Mergus serrator (Linnaeus). Red-breasted Merganser (130).*
H.V.O. Sept. 21, 1901.

Order FALCONIFORMES

Family ACCIPITRIIDAE

1. *Astur atricapillus atricapillus (Wilson). Eastern Goshawk (334).*
H.V.O. Oct. 7, 1896.

2. *Accipiter velox velox (Wilson). Sharp-shinned Hawk (332).*
H.V.O. Sept. 11, 1901.
H.V.O. Sept. 17, 1901.

3. *Circus hudsonius (Linnaeus). Marsh Hawk (331).*
H.V.O. Sept. 26, 1901.

Order CUCULIFORMES

Family CUCULIDAE

1. *Coccyzus americanus americanus (Linnaeus). Yellow-billed Cuckoo (337).*
H.V.O. Sept. 19, 1901.

Order PASSERIFORMES

Family ALAUDIDAE

1. *Otocoris alpestris alpestris (Linnaeus) Northern Horned Lark (474).*
H.V.O. Sept. 19, 1901.

Family CORVIDAE

1. *Corvus corax principalis Ridgway . Northern Raven (486a).*
H.V.O. Sept. 9, 1901.

Family FRINGILLIDAE

1. *Zonotrichia querula (Nuttall). Harris's Sparrow (553).*
H.V.O. Sept. 18, 1901.

II. ST. LAWRENCE ISLAND and ALASKA

Order CHARADRIIFORMES

Family LARIDAE

1. *Xema Sabini (Sabine). Sabine's Gull (62).*
Aug. 18, 1899.

2. *Sterna paradisaea Brünnich. Arctic Tern (71).*
Summer, 1899.

Family ALCIDAE

1. *Fratercula corniculata (Naumann). Horned Puffin (14).*
July 10, 1899.

THE RANGE OF THE BISON IN WISCONSIN

A. W. SCHORGER

The former range of the bison (*Bison* b. *bison* Linn.) has been outlined by Allen[1], Hornaday[2], and Seton[3]. The distributional area in Wisconsin was approximated on the basis of a few references only. A more thorough investigation of the literature permits defining the range more accurately, but not to a degree commensurate with the labor involved.

A study of this nature would not be complete without giving consideration to vegetative conditions during the period when the bison abounded. The southern and western portions of Wisconsin were covered formerly, for the most part, with prairie and "oak openings." In fact, the northern edge of the bison range coincides surprisingly well with the Prairie post offices.*

The growth of timber during the past seventy-five years has obscured the former existence of an excellent bison habitat. The annual burning by the Indians maintained a region of prairies and open groves; so, for this reason, the map prepared by Chamberlin[4] in 1882, on which the prairie areas are shown, does not give a true picture of early conditions.

The prairie region spread, in the interior of the state, as far north as Lake Winnebago. Pére Dablon[5], who was at the Mascoutin village on the Fox River in 1670-71, states that the prairie extended more than three hundred leagues in every direction. Though this extent is questionable, later travelers found almost continuous prairie from the site of the present city of Oshkosh to Portage. Col. Whittlesey[6], who traversed the region in 1832, found, after crossing the Fox River at Lake Winnebago, a low rolling prairie that extended for fifty miles. This same region of prairies and oak openings was described in considerable detail by Capt. Marryat[7] who called it "beautiful beyond description".

In actuality, the prairie was almost continuous from Lake Winnebago to the Illinois line. Mrs. Kinzie[8], in March, 1831,

* Star Prairie, St. Croix Co.; Prairie Farm, Barron Co.; West Prairie, Vernon Co.; Prairie du Sac, Sauk Co.; Strong Prairie, Adams Co.; Rolling Prairie, Dodge Co.; and North Prairie, Waukesha Co.

journeyed from Fort Winnebago (Portage) to Chicago by way of Blue Mounds. After leaving Lake Mendota, the trail to Blue Mounds was over a rolling prairie. Thence her party went south for fifty miles over a prairie on which it "vainly hoped to see a distant fringe of timber". On the return journey, she also mentions that after leaving the Madison lakes, the party, to reach Fort Winnebago, crossed "Twenty-Mile Prairie" without a tree in sight.

The first recorded overland journey from Chicago to Prairie du Chien was made by Keating's party in 1823. It entered the state near Monroe, crossed the Military Ridge west of Blue Mounds, and proceeded to Prairie du Chien. Keating[9] makes this significant statement: "The only defect which we observed in the country between Chicago and the Mississippi is the scarcity of wood, which is more seriously felt on the west side of Rock river than to the east of it." Incidentally, he remarks on the extreme scarcity of game.

A map[10] of southwestern Wisconsin published by R. W. Chandler in 1829, states that not more than a tenth is covered with timber, in detached groves, the remainder being prairie. Daniels[11], the first state geologist, stated in 1854 that only one-third of southwestern Wisconsin was prairie. He gives, however, the reason for the rapid disappearance of the prairie: "An interesting and valuable feature may be mentioned in this connection, viz: The rapid growth of young trees from the soil of the open prairie, wherever the annual fires are shut off. Upon Judge Blackstone's farm, near White Oak Springs, we were shown dense groves of young trees, from six to ten inches in diameter, where, twenty-five years ago, not a shrub could be found larger than a riding whip. The same process may be seen in numerous localities, at various stages of advancement, from the prairie, covered with sprouts of oak, hickory, aspen, hazel, and sometimes maple, linden, and ash, to thick groves which have been growing for many years. . . . If proper precautions are taken to protect the surface from the fires, every farm upon these prairies will supply itself with timber in a few years."

Fixation of the range of the bison is complicated greatly by the loose terminology of the early French voyageurs. Some of the English translations add to the confusion, so that the French

texts should always be examined. Many writers have used *buffle, boeuf, boeuf sauvage,* and *vache sauvage* indiscriminately for the bison, moose (*Alces malchis*), and wapiti (*Cervus canadensis*). In general *élan, orginal* (*orginal*), or *oriniak* refers strictly to the moose. The wapiti was called *cerf, vache sauvage,* or stag (stagg). *Cerf* would be fairly descriptive as it is the French name of the European stag or red deer. Michaux[12] states that the French and Canadians of Illinois call the American elk *cerf* and the white-tailed deer *chevreuil.* In Europe the *chevreuil* is the roebuck. It must be said that many of the French writers had a "boosting" spirit and wished to make the natural advantages of the country attractive by naming as many mammals as possible. Fortunately, it is an exceptional case in which any word other than *boeuf* can be translated bison for Wisconsin.

The range of the bison will be followed from the northwestern corner of the state, southeasterly to Lake Michigan. Schoolcraft[13], in 1820, found buffalos in Minnesota where the Elk River empties into the Mississippi. They did not appear there in 1821, and the Chippewas stated that 1820 was the last year that these animals crossed to the east bank of the Mississippi. The place where the buffalos were found was 40 miles west of the Wisconsin boundary in latitude 45° 20′. Father Hennepin[14], while a captive of the Sioux, was on the St. Croix River in 1680. He mentions an Indian grave near which the savages left a pot containing fat buffalo meat (*viande grasse de Vâches ou Taureaux Sauvages*).

It is highly probable, aside from historical evidence, that the bison ranged to the eastward of the St. Croix River. Schoolcraft[15], in 1831, found that "the prairie country extends itself into the vicinity of Rice Lake (Barron Co.)," and that along the Red Cedar River the forests were interspersed with prairie.

The journeys of Radisson and Groseilliers are a geographical as well as a zoological problem. In his Third Voyage, 1658-1660, Radisson[16] mentions the occurrence of "Buffs" about the lake of "ye Stinkings" (Michigan) and states that they come to the "upper lake" (Superior) but by chance. He gives a good description of the buffalo and mentions slaying it during the winter hunts. Careful reading of his voyage leads to the conclusion that his first experience with the buffalo was obtained on the

upper Mississippi, probably near the Bois Brulé-St. Croix waterway.

In the late fall of 1661, in the course of his Fourth Voyage, Radisson made an overland journey from Chequamegon Bay to Lake Namakagon, apparently, the Indians then scattering for the winter's hunts. In the beginning, game was abundant and he[17] mentions the killing of "Oriniaks, staggs, wild cows, Carriboucks, fallow does and bucks". Some antiquarians have assumed that his *wild cows* were buffalos. For various reasons, it is most probable that he refers to the female wapiti. He and his associates in the course of the winter wander westward to the St. Croix and beyond, into the country of the Sioux. He then makes several references to their buffalo culture, always using the word "buffe" or a variant. Furthermore, while returning homeward from his Third Voyage his party killed "wild cowes" on the Ottawa River, Canada, 30 leagues below the Calumet Rapids. The buffalo never occurred along the Ottawa. That the moose was not intended is shown by the fact that an *horiniack* was killed shortly afterwards. The cow moose is more mulish than bovine as attested by some of the early French travellers.

Bison were common in certain localities along the Mississippi River, from Lake Pepin to the Wisconsin River. Buffalo River in Buffalo County perpetuates their former abundance. Hennepin[18] was the first to mention *"la Rivière des Taureaux Sauvages,"* stating that it was so-called from the large number of buffaloes ordinarily found there. It was described as skirted by mountains, but these were sufficiently distant in places to leave prairies. The Indians with him made a hunt on this river. Returning, laden with meat, their women concealed it on the islands at the mouth of the stream. He also mentions buffalos at Lake Pepin (*à la pointe du Lac des pleurs*), and an occasion on which some sixty buffaloes with their young (*soixante Taureaux, ou Vâches Sauvages avec leurs veaux*) crossed a river. The side of the Mississippi on which they were found is not determinable. Pike[19] mentions a Point de Sable projecting about a mile into the lake from the west side.

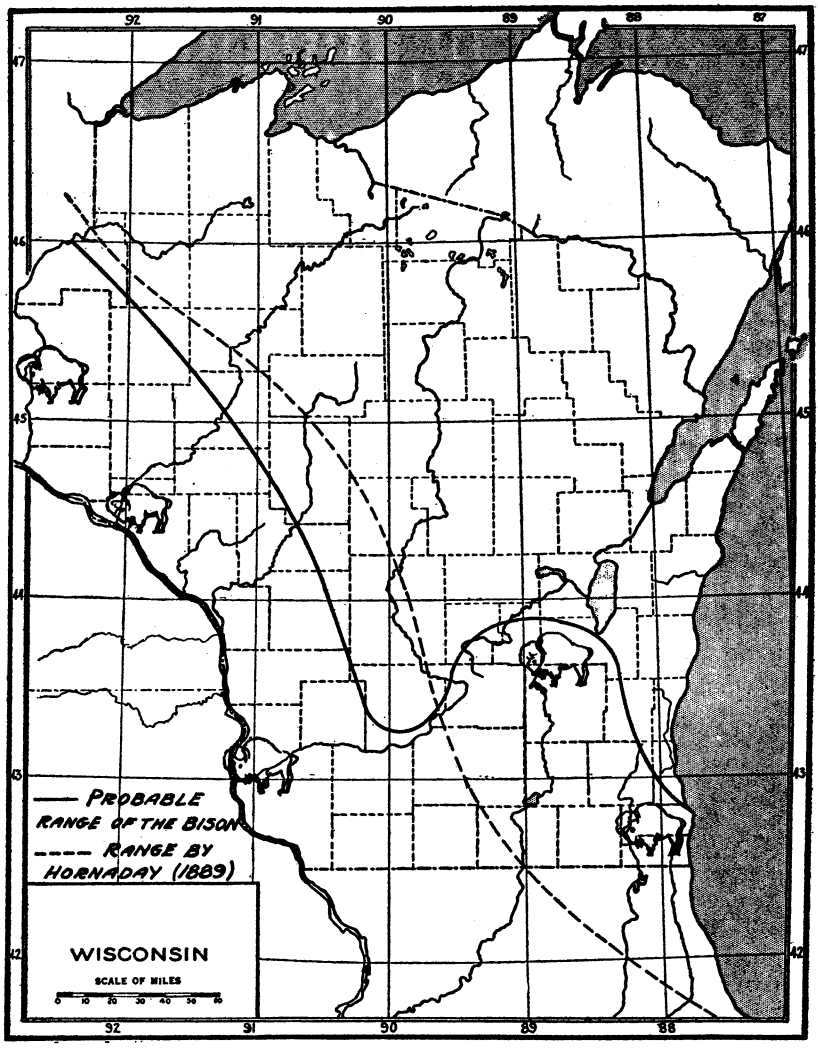
La Salle[20], in a letter written in 1682, mentions the *"Rivière des boeufs"* that owed its name to the large number of those animals found there. In 1699, Le Seur[21] described a large, beau-

tiful river coming from a great distance, and flowing at its mouth from the north. This was called the Bon-Secours from the great number of bison (*boeufs*), wapiti (*cerfs*), bears, and deer (*chevreuils*) found there. This river has been identified with the present Chippewa River[22], and from all the evidence, correctly so. It is difficult in some cases to decide whether the Buffalo or Chippewa River is intended, the two streams being about 10 miles apart where they enter the Mississippi. Hennepin states that his *Rivière des Taureaux* is a whole league from Lake Pepin (*une grande lieüe du Lac des pleurs*), so that it must have been the present Chippewa River.

A glance at a detailed map permits some interesting conclusions. About 12½ miles above the mouth of the Chippewa a branch known as Beef Slough leaves the river. This slough, known also as Boeuf Slough[23], even in modern times, curves to the southeast for 18 miles to join the Mississippi, thus forming with the main Chippewa a large delta. The present Buffalo River, that is only 30 yards wide at its mouth, empties into the lower end of Beef Slough 9½ miles below the main mouth of the Chippewa. Strictly speaking, the Buffalo River is accordingly a tributary of the Chippewa. More to the point is the fact that the voyageurs keeping to the main channel of the Mississippi would not be likely even to see the Buffalo, this river and the slough being relatively insignificant. It is apparent then that when Chippewa predominated as the name of the main stream, the slough and its tributary fell heir to *Boeuf*.

It would seem that both rivers had bison on the banks so that a further discussion of the names would not be in place. Long[24], in 1817, states that buffalos while not numerous on the "River au Boeuf" (Buffalo River) were still hunted there by the Indians at all seasons.

The Chippewa valley was unquestionably the greatest game region in the state. Carver[25] ascended the river in June, 1767, and observes "larger droves of buffaloes and elks" than in any other part of his travels. He describes the land along the river as very level for sixty miles and clothed with fine meadows. His account establishes the distance that the buffalo ranged to the eastward in this latitude. The country was almost devoid of timber up to Chippewa Falls, but rugged and heavily timbered beyond.



Range of Bison in Wisconsin.

The Wisconsin Historical Society recently received from the library of McGill University a copy of the "Military Journal of Captain James Stanley Goddard made in 1766-7". He left Mackinac September 17, 1766 and stopped at the Sauk village in Sauk County. He remarks that the Sauk Indians are good hunters and have horses "which they use to hunt Buffalos on in the summer time". He accompanied Jonathan Carver on his voyage

up the Chippewa River. The journal contains the following entry for May 29, 1767: "This is a fine river . . .; there is plenty of animals, such as stag, deer, bear and buffalos, of which we killed every day one sort or other". Acknowledgment is made to the Society for their kind permission to use the above excerpts.

It is improbable that the bison occurred in the south-central part of the state. Here, the terrain is rugged and was well wooded. To the northward lay the "sand barrens."

The drawings of various animals in a cave near West Salem, La Crosse County, have been described by Brown[26]. Two of the pictographs here reproduced (Pl. 1, figs. 1-2) unquestionably represent the bison. The technique indicates Siouan origin, though the quality is below that of some of their more modern paintings. The Sioux formerly occupied or claimed the east bank of the Mississippi from the mouth of the Wisconsin River to Mille Lacs, Minnesota.

Bison were found in numbers near the mouth of the Wisconsin River up to the latter part of the eighteenth century. B. W. Brisbois[27] was born and raised at Prairie du Chien. He was told by a Mrs. Cardinal (Cardinell), who came to Prairie du Chien about 1767, that buffalos crossed the river in such numbers that it was necessary to wait for the hordes to cross before a canoe could pass safely. La Salle[28], writing under date of Aug. 22, 1682, expresses his concern that Du Luth may interfere with the fur trade that he is establishing on the Wisconsin "on account of the great number of buffaloes (*boeufs*), which are taken there every year, almost beyond belief."

There is no specific reference to the bison on the Wisconsin River between Prairie du Chien and Portage. Marquette[29], in his memorable journey from Green Bay to the Mississippi in 1673, states that while on the Wisconsin River, he saw no small game or fish, but many deer (*chewrëilz*), and a large number of "cows" (*Vaches*). Shea[30] translates *Vaches* as moose and states that it is clearly a mistake to assume that bison is intended.* His argument is based on the fact that Marquette does not mention the bison until he arrives on the Mississippi in latitude 41° 28′. Marquette gives then a description of the bison under the name

* It is just as great a mistake to translate the word as moose for the lower Wisconsin is far below the former range of this species.

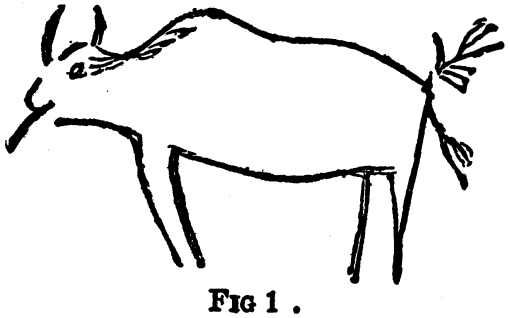


FIG 1 .

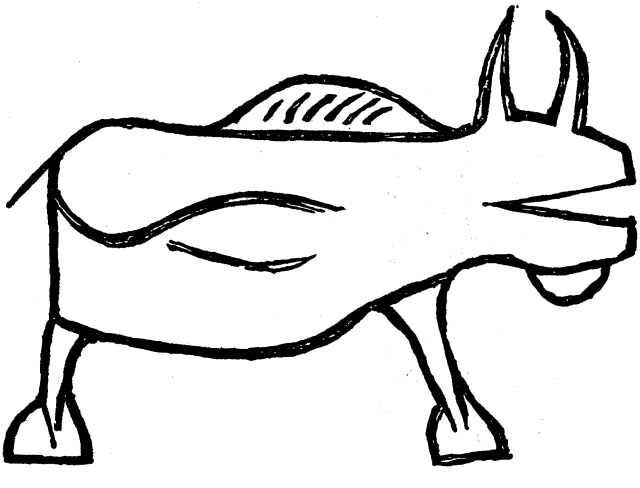


FIG. 2.

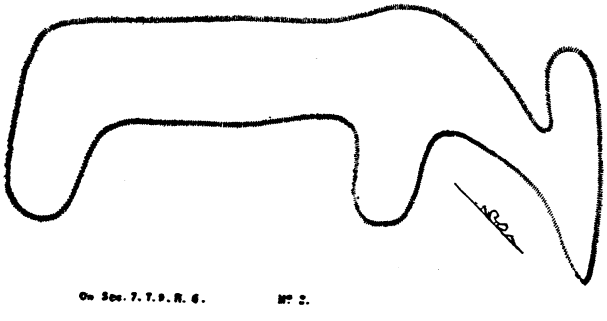


Fig. 3.

FIGS. 1 and 2. Bison Pictographs, LaCrosse Co.
FIG. 3, Bison Mound, Sauk Co.

*pisikiou*** or *boeufs sauvages.* On Marquette's map the bison is *Boeuf sauvage.*

It is likely that the *vaches* seen by Marquette on the Wisconsin River were wapiti, even though he later speaks of bison, wapiti, and kids (*boeufs, cerfs, chevreux*)[31]. Dablon's Relation[32] was probably available to Marquette before he set out on his voyage. Dablon was at the Mascoutin village, modern Berlin[33], on the Fox River, in 1670-1671. In describing the prairies south of Lake Winnebago he mentions that "wild cows" (*vaches sauvages*) are encountered not infrequently in herds of four and five hundred each. He must refer here to the American elk, considering the size of the herds, and the fact that he immediately proceeds to describe in detail the bison occurring in the same locality. Dablon was the first to use the name *pisikiou* as a synonym for the buffalo (*buffle*).

There are several other references to the occurrence of the bison in the region south of Lake Winnebago. Allouez[34], writing of his journey to Lake Superior, 1665-1667, states that the Outagamie live southward towards the lake of the Ilimouek (Michigan), in a country favorable to the hunting of wapiti (*Cerf*), bison (*Boeuf sauvage*), and other animals. When he actually visited these Indians in 1670, he found them living on the Wolf River. He does not mention the bison again, but states that large and small stags (*grandes et petits Cerfs*), bears, and beavers are found in abundance.

Perrot[35] visited the Wisconsin tribes in 1666 and mentions the bison in several cases. He states that shortly after the Indians had formed a new settlement near Green Bay, they went to hunt bison (*Boeufs*) and returned in a fortnight loaded with meat and grease. Since it took the French five days to reach the Mascoutin village (Berlin), it is safe to assume that the hunt was made on the prairies south of Lake Winnebago. The Indians could scarcely have gone farther, killed the game, and returned in the time specified. After reaching the Mascoutin village, Perrot mentions that he was seated on a painted bison robe "the hair of which was softer than silk." His food was seasoned with bison fat (*graisse de boeuf*), and he left his gun with the Indians in order that they might use it to hunt bison.

** Mr. M. W. Stirling of the Bureau of American Ethnology has informed me that *pisikiou* is evidently intended for the Menominee word *pisähkiw*, meaning buffalo. The plural form is *pisähkiwük.*

While voyaging up the Fox River in 1690-1691, Perrot[36] was presented with a bison (*boeuf*) and some maize that were of great assistance to the Frenchmen on their journey to the Mississippi. De Beauharnois[36a], in May, 1730, writes that the allied Ottawas, Sauteurs, Menominees, and Winnebagoes destroyed twenty flatboats of Foxes returning from a buffalo hunt.

Their former presence was mentioned by travelers in the region as late as 1837[37]. Richard Dart's family, the first to settle at Green Lake, took up a claim south of the lake in 1840, when he was twelve years of age. In 1906, he stated: "We saw no buffalo, but their wallows and chips and horns were visible, and seemed recent. [Pierre] Le Roy* said that he had seen these prairies black with buffalo[37a].

The lakes formed by the widening of the upper Fox River were known on the early French maps as the Wild Rice Lakes (*Lacs de Folles Avoines*). The first reference that has been found to *Lac du Boeuf*, the present Buffalo Lake, is in 1777-1778[38]. The French name of this lake was used also by Featherstonhaugh[39] who traversed it in 1835. William Powell[40] (1810-1885), who was interviewed in 1877, states that the Buffalo Lake region was a great buffalo range in early times. The oldest Menominee living had never seen buffalos in Wisconsin. Iometah, an aged Menominee, who died about 1867, and others stated that their fathers had killed and driven them off.

The discoveries of Recent and fossil remains of the bison are distinctly limited. Hay[41] received from Dr. S. Weidman, State Geologist, a humerus, classed as Recent, found in a marsh near Oshkosh. This indicates that the bison may have ranged to the northern end of Lake Winnebago on the western shore.** Recent bones have also been found on the site of the old French post near Trempealeau[42].

The bison remains found by Whitney[43] in a lead crevice at Blue Mounds, Dane county, appear to belong to an extinct species. Of exceptional interest is the recent discovery of the remains of approximately forty *Bison b. oliverhayi* in a peat bog in

* It would be possible to approximate the date of the disappearance of the bison if the date of Pierre Le Roy's birth were known. He was in the Kinzie party in their journey to Chicago in 1831. Mrs. Kinzie speaks of him as "young" Roy.

** In 1765 there was published in London, "A Concise Account of North America", by Major Robert Rogers. In describing Green Bay, page 164, he mentions the tall grass growing between the trees and adds: "This invites hither the greatest plenty of deer, elks, buffalos, wild cows, bears, beavers, ..." The work is obviously a compilation and there is no historical evidence that the author had first hand knowledge of the country west of Mackinac.

the St. Croix watershed[44]. No bones of *Bison b. bison* were found with them.

The Winnebagoes are of Siouan linguistic stock, but are not known to have resided outside of the Wisconsin region. The stronghold of the tribe was in the Lake Winnebago district. They first became known to the whites in 1634 when Nicollet found them at Green Bay. Though culturally a distinctly timber people, the Winnebagoes had a buffalo clan, and their most important ceremony was the buffalo dance. Thwaites[45], in 1887, interviewed Moses Paquette, interpreter for the Wisconsin Winnebagoes, who described the buffalo dance as still the tribe's most popular ceremony.

No reference was found to the occurrence of the bison in life in extreme southern Wisconsin though conditions were very favorable for their existence in abundance. There are no accounts of whites traversing this section prior to 1800. It remained a *terra icognita* due to being off the main waterways. The water routes followed by the French were the Fox-Wisconsin to the Mississippi and the Lake Michigan shore to Chicago. While the identification of effigy mounds leaves much to the imagination, the occurrence of "buffalo" mounds on the southern prairies is of some significance. Lapham[46] has described, among others, two buffalo mounds along Honey Creek, at the edge of the Sauk prairie, Sauk County. One of the mounds is shown as Fig. 3 (Pl. I). He considered the animals to be grazing in an attitude "quite spirited and natural." The list of the mammals of Sauk County published by Canfield[47] contains the following brief reference: "*Buffalo.*—Had all left before the country was purchased of the Indians."

A group of six animal mounds in single file was described by Taylor[48] in 1838. The group was situated in Dane County eighteen miles west of Madison and seven miles east of Blue Mounds. He seems to have made a careful survey but is in doubt as to the animal that the figures are intended to represent. He decided in favor of the buffalo, because of its former abundance in the surrounding prairie. In 1836, Featherstonhaugh[49], after leaving Blue Mounds, saw on the prairie "seven buffalo mounds, each representing distinctly, the head, horns, neck, fore and hind legs, body, and tail of that animal." In spite of certain discrepancies in the drawings, there is no doubt but that this was the same group surveyed by Taylor. Taylor's animals resemble

the bear, while Featherstonhaugh's drawings are too distinctly bovine to be credible.

It is stated by T. V. Kumlien[50], in a private paper now in the possession of Mr. Angie Kumlien Main of Fort Atkinson, Wisconsin, that the early settlers found buffalo horns in the vicinity of Lake Koshkonong. There were no permanent settlements in Jefferson County, prior to 1835, so that the existence of horns at this date would indicate that the buffalo did not disappear from the region prior to 1800.

Marquette[51], in the course of his last voyage, skirted the western shore of Lake Michigan. He mentions, on Nov. 27, 1674, that after proceeding about three leagues from "the river" (Milwaukee) he found savages who had killed some bison (*boeufs*). This would be in the vicinity of Racine. Marquette is consistent in his use of *boeuf*, and there is no doubt that he refers to bison. Proceeding on to the Chicago River, his men, Pierre and Jacques, killed three bison.

It is surprising that the bison was found so long in Wisconsin in view of the fact that it was almost extinct east of the Mississippi prior to 1815. Hoy[52] states on the authority of Governor Dodge that buffalos were killed on the Wisconsin side of the St. Croix River the year following the close of the Blackhawk war. This would be 1833. Lapham[53] states that the buffalo was seen last east of the Mississippi in 1832. Agreement is good as to the date of extinction for Sibley[54] reports that the Sioux Indians killed two bison on the Trempealeau River in 1832. There is a melancholic reflection in his words: "They are believed to have been the last specimens of the noble bison which trod, or will ever again tread, the soil of the region lying east of the Mississippi river".

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GENETIC HISTORY OF CATTLE IN WISCONSIN*

GEORGE WALTER WOOLLEY

INTRODUCTION

This study was begun at the suggestion of Dr. L. J. Cole, who pointed out the need of a genetic history, or at least a historical survey, of the cattle of Wisconsin. At that time, as at present, there was no available source of information of this nature. This condition was almost equally true for American cattle in general.

The vast majority of the cattle of the state have at all times been unregistered. Without a knowledge of the different foundation stocks entering the general population there was no satisfactory method of determining the per cent and kind of different blood making up the unregistered cattle of the state. Unlike the registered breeds, which are closed to outside blood, various bloods could have entered into the make-up of these cattle from time to time. This paper is an attempt to evaluate the present cattle population on the basis of the different groups that have been brought into the population during its development. At present the work is complete to 1860. From 1860 to 1890 the emphasis has been placed on dairy cattle.

EARLY INTRODUCTION OF CATTLE INTO WISCONSIN

European and American Background.

When representatives of the European nations came to the North American continent in the fifteenth century no domestic cattle, *Bos taurus,* were found. American bison were present, but these never proved satisfactory animals for domestication. Importations of varieties of domestic cattle from Europe started with the establishment of the first settlements and have continued up to the present time.

For many years the cattle of America merely reflected various types that were present in Europe. Within Europe they differed greatly in size, color and form, even between sections

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of a country. Excellent reviews of these cattle are given in the United States Consular Reports of 1887, and by Morse, 1910. In this paper, breed terms have been used as a basis for classification of these differences, except in a few instances where it has been found expedient to use geographical distribution.

The cattle of the older North American settlements may readily be separated into three divisions. On a geographic basis these might be termed Spanish, English and French, respectively. In general, these divisions developed independently until

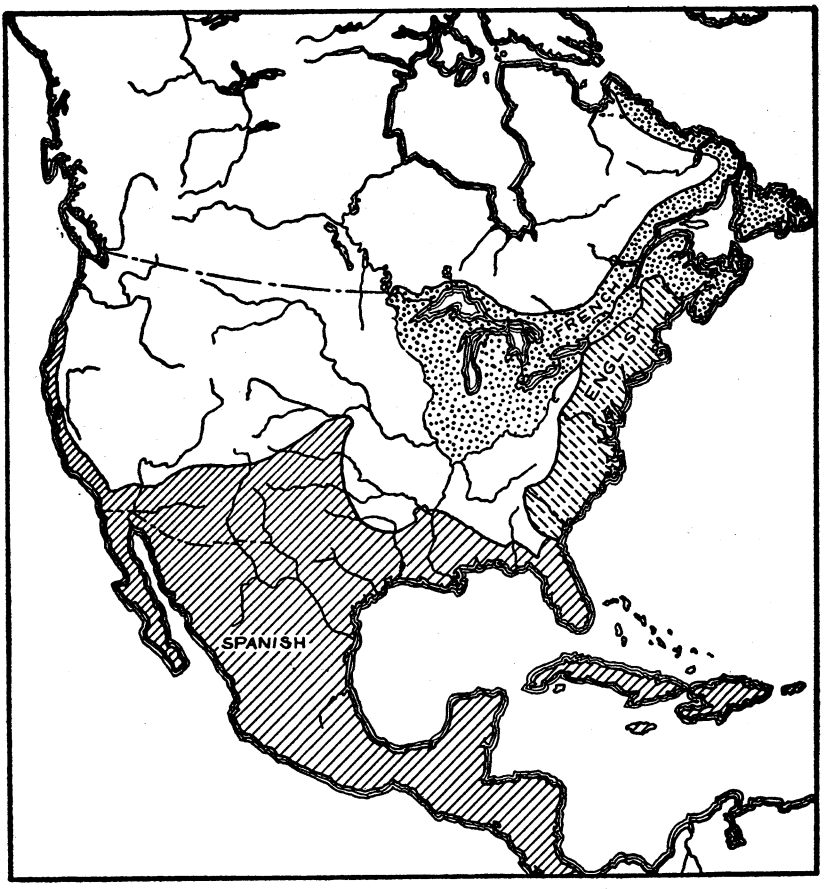

FIG. I. *Distribution of Cattle in America about 1750.*

Three geographically distinct divisions of cattle were present in North America. The lower Mississippi, however, probably possessed a number of cattle of French importation, as well as of Spanish importation, and the southern English colonies a few of Spanish origin.

after 1800. The three came together in Missouri near this latter date. (Fig. 1.)

The first two of these, the southern and the central, may be eliminated from the picture of the early cattle of Wisconsin. Of these two, the former never became of importance to Wisconsin at any time. The cattle of this division, first brought by the Spanish to the West Indies and then to the entire coast from Florida to Mexico[1], were only of importance in the south and southwest part of the continent[2]. Cattle of the central, or second division, formed the foundation stock for the progressively westward moving "cow country" of North America. These cattle are discussed in connection with a later group of cattle in Wisconsin. It is of interest at this time to know that after remaining east of the Alleghenies for many years, their first move westward was from Virginia, to Kentucky and Tennessee. They reached Ohio by 1773. Other cattle are known to have been present in Wisconsin at this time.

The third division includes the cattle brought to the St. Lawrence. These are of particular interest here because of their importance in the French Northwest, of which Wisconsin was a part. French and Portuguese fishermen who settled in little groups along the Newfoundland shore were the first to make importations of cattle to this region. Starting as early as 1518[3], and 1525[4], these preceded even the adventurous Cartier, who discovered the St. Lawrence river for France in 1534. Only fragmentary history exists concerning these early importations[5].

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[1] In 1495 cattle were sent to the Indies. Whitaker, p. 3. The first reliable data as to cattle on the continent are contained in a written report found in the Spanish Archives at Madrid, to the effect that Gregario Villalabos in 1521, went to Spain (now Mexico) as Governor General or Vice-roy. Villalabos landed near the present town of Vera Cruz, Mexico, and according to the manuscript, "brought a number of calves from Santo Domingo, he being the first to bring them to New Spain." Saunders p. 709. For early mention of the cattle of Porto Rico, see Memoir of Melendez, 1565, and for the Gulf region in general, Memoir of Sieur de la Salle, 1678.

[2] See Schlarman for the relation of d'Iberville's colony, Louisiana, to the French Canadian and Indian colony on the Kaskaskia.

[3] In 1518 Baron de Lery made an abortive attempt at settlement on Sable Island where the cattle left by him remained and multiplied. Parkman, p. 172.

[4] Saunders, p. 107, 1925.

[5] Parkman, p. 211-212, treats of the attempt of the Marquis de la Roche to plant Christianity and civilization in the west. This catholic nobleman of Brittany landed forty of his colony of convicts on Sable Island while he and a few trusty followers explored the neighboring coast for a site for the new capitol of his domain. Meanwhile a storm drove him out to sea and he returned to France. Twelve survived until relief came five years later, 1603. "For food they caught fish in the surrounding sea, and hunted the cattle which ran wild about the Island, sprung perhaps from those left here eighty years before by Baron de Lery."

[6] Gorham.

Undoubtedly the animals of Cartier, 1541, and of the Roberval Expedition, 1842, were lost, as the settlements proved abortive. The cattle brought by de Monte and Champlain to St. Croix Island in 1604 started a more permanent group. This colony was moved to Port Royal in 1605, and more animals added in 1610[6]. Mention is again made of these in 1613 and in 1629. Near this latter date cattle were first brought to Quebec, and following this, to other points along the St. Lawrence.

Cattle in this region were almost all from France and included two main types of cattle; those of Brittany and of Normandy. The first of these, the race Bretonne, is now interpreted as being a descendant of *Bos longifrons,* the Celtic Shorthorn, that had been kept pure for many years. It is characterized as a pie-black or black animal, hardy, a good milker, and measuring 3 feet 2 inches to 3 feet 6 inches in height at the withers. In contrast, the Norman breed is a descendant of *Bos primigenius,* and is described as one having an unprepossessing bony frame, long and heavy head, long of body, large, coat color variable, brown, red or piebald and never failing to present brown streaks over the surface of the body that have given rise to the term "brindled."

No critical information is available concerning the relative proportions of these two breeds that were imported. Frequent reference to small, black, and black and white cattle in the pioneer settlements of the French Northwest is assurance that the cattle of Brittany played an important part[7]. Small size was undoubtedly of great aid in transportation as the early French in Canada travelled mostly by water. A number of references to ring-streaked, or brindled animals among the French cattle of Illinois, and of Wisconsin, exist for a later period. A combination of these early types, together with subsequent selection, produced the distinctive French-Canadian breed of this day.

Following the establishment of cattle in Lower Canada, cattle were taken from this region to the territory to be known as the French Northwest of the 17th century. This territory, between

[7] Charlevoix visited the Illinois in 1721 and wrote: "the inhabitants of Kaskaskia have black cattle and poultry and are doing well." Reynolds, p. 33. See Journal of Peter Pond for black cattle at Green Bay 1774 (Wis. Hist. Colls., 18, 329). (Quebec) "The cows have likewise been imported from France, and are about the size of our Swedish cows. . . . The cows vary in color, most of them either red, or black." Per Kalm. Vol. 2, p. 327, 1749. Thompson notes black cattle at Vincennes after its founding in 1735, and at Fort Chartres in 1767. Black cattle were at Cape Girardeau, just across from Kaskaskia, W.H.C. Vol. 22, p. 58.

the Great Lakes and the Ohio, has been described as a wilderness, covered by forest and prairie, thinly peopled by Indians, and with here and there French forts, the only points of civilization in the whole region. Detroit on the south and Mackinac on the north were centers for the securing of supplies. Occupation was only along the waterways, the rivers and lakes, and at the most strategic points for fur trade. As cattle were taken into this region, they, too, were to be found only in limited areas.

The first record of cattle in the west is at Detroit[8], in 1707, soon after the founding of the colony by Cadillac[9]. In the first half of the following century cattle were taken to the prominent French posts of Vincennes, Kaskaskia, Mackinac and Sault Ste. Marie. In the latter half of the century they were found in Green Bay, Grand Portage, and Prairie du Chien, posts of special interest to the history of Wisconsin.

Within Wisconsin during this latter period, the posts at both Green Bay and Prairie du Chien began to attain a measure of prominence. Other villages within Wisconsin were intermittently maintained. A few French and half-breeds were engaged in trade and transporting canoes at Portage and some were at Chequamagon and the Fond du Lac post in the north.

Cattle at Green Bay

The first reference to cattle in Wisconsin that has been found is that for the Green Bay settlement. This was to be expected from a knowledge of the early fur trading in the French Northwest. After having been the first point in Wisconsin to have been reached by a white man, Nicolet, 1634, it became one of a great line of French forts, or points of aid, for French traders in their barter with the Indians for furs. In the first part of the eighteenth century these forts described a broad arc from Quebec, up the Great Lakes and down the Ohio and Mississippi rivers, to the Gulf of Mexico.

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[8] W. H. C. Vol. 16, p. 268, 270.

[9] "Antoine de la Monte Cadillac, Lord of Bonaget and Montdesert, and Commandent for the King at Detroit, acting under a commission from Louis XIV and being granted fifteen acres square, left Montreal in June, 1701 with one hundred men, a Jesuit missionary, and all the means for the erection of a colony; and reached Detroit in July of the same year, where they commenced the foundation of the settlements. Before that period Detroit had not been unknown. As far back as 1620, it was the resort of French missionaries, and when first visited by the French, its present site was occupied by an Indian village named Tenscha Grondie." Lauman, p. 40. See Severance, p. 197.

Green Bay became the first of the primitive Wisconsin settlements to attain much in the way of permanence. This settlement[10] dates from the time of the migration of the Sieur Augustin de Langlade, and his son Charles, from the region near Mackinac to Green Bay about 1745. The colony started with probably not more than eight persons, and as late as 1785 it did not exceed fifty-six souls. Very little is known regarding their conditions of life and for a number of years no mention of live-stock has been found. It is known that the settlement was closely allied to Mackinac, which, together with the Sault Ste. Marie, possessed cattle about 1750. Following the ceding of Canada to England, 1763, connection with the outside world increased. British subjects began to follow the route pursued by the French traders and to engage in the fur trade. Jonathan Carver visited Green Bay in 1766 and noted that the few French cultivated the land and appeared to live comfortably. In 1773, Peter Pond[11], a fur trader who, together with Joseph Frobisher and his brother, form the principal names associated with the earlier explorations beyond Lake Winnepeg, visited Green Bay. He recorded his observations in a Journal and in this is found the reference previously mentioned in regard to cattle at Green Bay. Unfortunately it does not give a clue as to how long they may have been present. Part of the Journal[12] in which he unmistakably speaks of Green Bay is as follows:

"In three or four Days we arrive at the Mouth of the Bay which is two or three Mile Brod. In the Mouth is Som Islands which we follow in crossing to the South West Sid & then follow ye Shore to the Bottom is Seventy Miles whare the fox River Empteys in to the Bay. We went a Short Distans up the River whare is a small french Village and thare incampt for two Days. This Land is Exalent. The Inhabitants Rase fine Corn and Sum Artickels for fammaley youse in thare gardens. They have Sume trad with ye Indians which Pas that way. On the North Part of the Bay is a small Villeag of Indians Cald the Mannomaneas who Live By Hunting Cheafley. They have an-

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[10] Wisconsin Magazine of History 1:295. Smith, Vol. 1, p. 113.

[11] A copy of a map in Yale University Library entitled, "Travels of Capt. Peter Pond", has the winter residences of Pond noted on the back. From this the year is interpreted to be at the first of a 1773-5 period. See Davidson.

[12] W. H. C. Vol. 18, p. 314-356. Reprinted from Conn. Magazine, Vol. X, p. 234. Gates, p. 30-33.

other Resois [resource]—the Bottom of the Bay Produces a Large Quantity of Wilde Rice which they Geather in Sept for food. I ort to have Menshand that the french at Ye Villeg whare we Incampt Rase fine black Cattel & Horses with Sum swine."

At the same date stock is again mentioned at Mackinac; their manure being used to fertilize the sandy gardens. Hay for this stock was then being brought a distance of thirty miles by boat, while for others it was transported over the ice during the winter.

The observations of Peter Pond are in part supported by the recollections of Augustin Grignon, an early Green Bay settler, whose memory may be said to extend to 1784-1785. He states: "Horses, cattle, hogs, and fowls were plenty as far back as I can remember: and must have been common in the settlement long before my day." He also recalls that cattle for beef were sold to traders passing into the Indian country.

A few years later, 1793, the English trader, Robert Dickson, writes as follows: "The land is poor and barren on the north side of the lake until near La Baye where the soil is excellent and the seasons are early. Here it has long been settled from Canada by people who sow a little grain and have about 100 cattle which run in the woods."

Cattle received more notice during the disturbances at the beginning of American control at Green Bay, 1814-1816, as well as in the following years when the increases in population produced problems relative to sources of food. In Bullock's letter to Captain Loring it is said: "In my reply to the information required by the General, I am sorry to say that our resourses here are very few, and in that of the articles of provisions almost consumed—only 68 pounds of salt meat in store. The proportion of animal food purchased was so small that I found it necessary on the 1st of November to reduce the ration of beef to half a pound per day, and since, on the 25th Decmr. to limit the issue of meat to four days in the week,—at the above rate—so that the troops might have a small proportion of that food as long as possible, and which they will have until about the middle of the ensuing month." John Lawe, one of the most prominent livestock raisers complained a few years later that: "the soldiers has reduced me in cattle so that I have but few remaining. 2 Years running I could never save a calf nor a pig." Losses of

cattle reported to the Court of Inquiry as due to Indian depradations totalled eighty-eight head; eleven calves, two heifers, twenty-eight cows, six bulls, and forty-one oxen. Again in 1824, John Lawe complained that: "there has been a great number of U. S. troops garrisoned or that are stationed at Green Bay, but what good does that do me it is only to assist in ruining of me and the Pilfering or general Stealing, Killing of cattle, and the committing of every kind of depredation."

Throughout the period of early United States control, the Green Bay community continued to have the native, or French, cattle population, even as it remained essentially French in habit, custom and language. General Ellis's Recollections for 1822 picture the conditions as follows: "the residents on the river except some half dozen Americans were retired French Voyageurs, and half-breed French and Menomonees; they had without let or hindrance, taken up the whole shore of the river above the fort, for six miles; divided it off into little strips of one or two French arpents in width, which they called their farms; they claimed back at right angles from the river eighty arpents, about two and three-fourths miles in depth. They had reduced most of the fronts for an acre, or two, or three, some more, some less deep, to a state of cultivation; and had growing at the time of our arrival, the first of September, very fair crops of potatoes, maize, oats, peas, spring wheat, pumpkins, melons, cabbages, onions, and other common vegetables. Most of them had teams of native oxen, and a kind of implement claimed to be a plow, with which they broke the soil. This plow went on wheels one of which was twice the size of the other, the larger one going in the furrow, and the smaller one going on the land. The plow beam was fourteen feet in length; the chip, on which the share was fastened, was four feet long, and altogether, when in motion was drawn by six or eight bulls, it was a formidable object, and answered well the end of its construction. . . . These bull-teams were a curiosity to a raw American. The animals were unblemished—the yoke was a straight stick of hickory worked off smoth, and bound to the bulls necks just back of the horns."

The progress of the French in the raising of cattle at Green Bay was not great when compared to that of the French in Illinois during the same period, and extensions of cattle that might

be attributed to the Green Bay settlement were few. From the Indian agent at Mackinac it is learned that the Ottawas residing at the river Shaboigan (Sheboygan) had progressed considerably in the arts of agriculture by 1816, and had applied to him for cows, hogs, fowls, etc. About 1814 Mirandeau, at Milwaukee, secured two cows from Chicago. They were brought for beef to the Chicago (Fort Dearborn) garrison and being milch cows were purchased and brought to Milwaukee.

No direct statement has been found regarding the source of the Green Bay cattle. It is known that their horses were from Detroit, and their sheep directly from Mackinac. It seems probable that the cattle were secured from one of these points along the water route[13]. Detroit was the first agricultural post in the west, and notices regarding cattle at that point have been found as early as 1707. It is known that corn and supplies were secured for Mackinac from Detroit, starting as early as 1715. Cattle were present at Mackinac and at Sault Ste. Marie by 1751, and at this time it was planned to have the care of the cattle take precedence over that of the cultivation of the land because it was thought that as Detroit and other southern posts became more settled they would supply an abundance of grain to the northern posts, which would send them cattle in return.

Cattle at Prairie du Chien

Prairie du Chien was a second point in Wisconsin to which cattle were brought before 1800. The natural advantage of Prairie du Chien, which was derived particularly from its situation at the junction of two large and navigable streams, the Wisconsin and the Mississippi, did not escape the observing eyes of the early French travelers and traders. A village was established by the French from Canada for the purpose of trade with the Indians. Reynolds[14] writes that this was built not long after the first discovery of the country, and occupied by Indian traders and farmers[15]. Carver, in 1766, found a large Indian village here, containing about 300 families; and he represents this place as "the great mart". Horses were present but no mention is made of cattle. Pond speaks of this as a "very handsome

[13] Kellogg, p. 390, interprets the early cattle, "probably from Detroit."
[14] Reynolds, p. 121.
[15] The author interprets the term farmer to mean collector of revenue for France; the collecting being let, or "farmed". See W.H.C., Vol. 16, p. 177.

plain" and tells of the gathering of the French and Indians. Large thirty-six oar boats were coming to this place from as far south as New Orleans and bringing such products as wine, ham and cheese.

The first evidence of cattle at Prairie du Chien is from the writing of the English trader, Robert Dickson, who was very familiar with this area near the close of the century. In a letter to the Hon. Robt. Hamilton of Queenston, 14 July 1793, he says: "about two leagues from where the Ouisconsin falls into the Mississippi there is a meadow about three leagues in width called Prairie du Chien. Here a good number of families are settled[16]. They have lately got cattle from the Illinois and begin to raise wheat". There seems to have been no regular settlement at the point Dickson refers to before 1781[17],[18], which indicates that, if true, the indefinite term "lately" as used would not cover a span of more than twelve years.

The Illinois, the place from which Prairie du Chien received its first cattle, was a region settled by the French from Canada at an early date. The Jesuit Fathers had put forth their best efforts to make farmers and stockmen out of the savages here, bringing cattle to the mission at Cascaskias (Kaskaskia) as early as 1712[19]. So well was this early work done that cattle were being returned to Detroit by 1743, where they were known as the Illinois breed[21]. In 1720, Illinois led in the cattle census of the colony of Louisiana[22]. In 1732, the Jesuits alone at Kaskaskia possessed 15 cows[23]. Cattle became more numerous here

[16] Their location was made on the Mississippi shore, about midway of the prairie, some distance above the site of what had formerly been an Indian village. Here a slough which they had designated the "Marias de St. Feriole", runs up from the river, and being generally filled with water, separates the principal prairies, a strip of lower ground, nearly a half a mile wide, and something more than a mile in length. Upon this tract, fronting the Mississippi and upon the border of the slough, these settlers erected their houses in groups, designated collectively as the village of "Prairie des Chiens", and that upon the mainland being designated by the name of St. Feriole". History of Crawford County, p. 281.

[17] History of Crawford County, p. 281.

[18] Reynolds states that the present site, about one mile above the old village, was built in 1783 under the English authority.

[19] Cattle may have been introduced at Cahokia (the Tamarois village) earlier than this. "Gabriel Marest came to Canada in 1694; four years later he began working among the Kaskaskias of Illinois with whom he spent the rest of his life—dying in that mission on September 15, 1714. He accompanied those savages when they removed from Peoria to Kaskaskia (in the summer of 1700) teaching them to cultivate the soil and raise domestic animals". W.H.C. Vol. 16, p. 179; from Jesuit Relations.

[21] Jesuit Relations, Vol. 70, p. 31, 35.

[22] Reynolds, p. 33-34.

[23] Morris, p. 7.

than in any other area in the French Northwest[24]. An early description of these cattle comes from Charlevoix, who visited the colony in 1721, and wrote: "the inhabitants of Kaskaskia have black cattle and poultry and are doing well." It was also said that these cattle were from Canada, a horned and hardy race, not large but neat of form.

The population of Prairie du Chien, from the census, is given at 65, in August 1800. In 1807, in the village of Prairie du Chien and vicinity there were 37 houses. A few cattle were also reported on the west side of the Mississippi at Giard's river at this latter date.

In following the progress in stock raising at Prairie du Chien it is found that as with Green Bay, great losses were suffered with the cattle during the war period of 1814-16. Notices regarding the cattle were infrequent near this date, however, and start with a brief reference which shows cattle to have been present in the settlement in 1812. Another reference mentions the order of one Nicolas Boilvin directing a man to drive up his cattle as he wished to kill a heifer that day and have some fresh meat. In 1814 as the fighting started it is recorded: "Many of them (Puants) in place of meeting the enemy immediately on their arrival ran off to the farms, killed the inhabitants' cattle and pillaged their houses even to the covering off their beds, and leaving many without a second shirt to put on their backs." Grignon also recollects that McKay had much difficulty in managing his Sioux and Winnebago allies, particularly the latter, and that they had in the most wanton manner shot down a number of horses and cattle belonging to the citizens. A few months later it was written that there were not 10 head of cattle left in the whole place where it could formerly boast of near 400. Another item states that several who two years before had upwards of 30 head of cattle have not now one left.

Cattle continued in the settlement, however, and Stephen H. Long describes the farming in 1817 as follows: "About one mile back of the village is the Grand Farm which is an extensive enclosure cultivated by the inhabitants in common. It is about six miles in length, and from a quarter to a half mile in width, surrounded by a fence on one side and the river bluffs on the other and thus secured from the depredations from the Cattle and

[24] Schlarman, p. 160.

Horses that were at large upon the prairies." In 1822 it could again be said that Prairie du Chien possessed cattle in considerable numbers. As will be shown later, replenishments, at least after the war period, may have involved some cattle from the now westward expanded cattle of English importation.

Cattle at Superior and in the North.

In 1807 cattle were reported at a third point in Wisconsin. These were in northwestern Wisconsin at the Fond du Lac Post, three miles down the St. Louis river, a location now within the present city of Superior, Wisconsin. The notice is from George Henry Monk, Jr.[25], which is in part as follows: "Three miles up the river St. Louis on the south side, the N. West Company has an establishment, of which the situation is low but commands a beautiful and romantic view of Lake Superior, of the river and the small lake.

"In the proximity the face of the country is either lakes or rivers of low fenny, or sandy, or high and craggy; few or no spots for civilization. Some of the lakes grow a scanty harvest of wild rice. . . . Here are two horses, a cow, a bull, and a few pigs; with manure of these animals a garden of three acres of pure sand is cultivated, which produces about 200 bushels of potatoes."

Many of the Posts in this section were without cattle at this early date. The Northwest Company possessed a fort and garden on the south side of Leach lake and had introduced horses and pigs[26]. Horses, cats and hens were present on the west end of Leach lake[27]. In 1820, twenty-one miles up the Fond du Lac river (St. Louis river) the N. W. company had transported to their establishment, with great difficulty, three horses, three cows, one yolk of oxen, and four bulls. Doty[28] reports that it was a great treat to obtain milk at this distance in the wilderness. By 1832 Sandy Lake could report thirty head of cattle, three or four horses and fifteen swine. In 1838, fifteen cows were at the upper Winnepeg post.

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[25] Written to Roderick Mackenzie, a partner of the Northwest Company, who contemplated writing a history of the company; by George Henry Monk, Jr., Leach Lake, 18 April, 1807. He speaks of it as "Some Account of the Department of Fond du Lac, or Mississippi." Minnesota History Bulletin, Vol. 5, p. 28.

[26] M. H. B., Vol. 5, p. 36.

[27] M. H. B., Vol. 5, p. 38.

[28] W. H. C. Vol. 13, Papers of James Doty.

settlement. Possibility of permanent cattle at this place starts with Michel Cadotte who took up residence at La Pointe on the southwest corner of Madeline Island at this time. Cadotte lived here at his ease for over a quarter of a century; cultivating a "comfortable little farm"; and commanding a fluctuating but often far-reaching fur trade, first as agent of the Northwest company and later for Astor's American Fur Company.

Chequamegon Bay (La Pointe) was another northern Wisconsin post that had cattle at an early date. Although traders had frequented this place since Radisson and Groseilliers had traded at Chequamegon Bay, 1654-1661, and this had been the site of the Jesuit mission of Allouez, 1665, and of Marquette, 1669, it is only since about 1800 that there has been a continuous

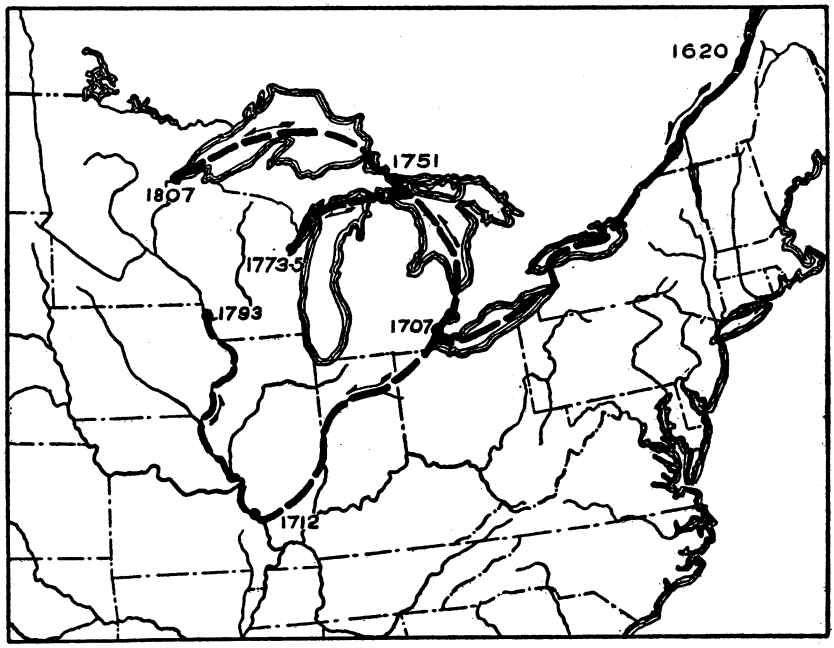

FIG. 2. *Routes of French Cattle to Wisconsin.*

The extension of cattle into the French Northwest was probably along the waterways, the common routes of travel of the time. This map shows some of the leading routes between points at which cattle are known to have been present, together with the first positive dates; Quebec 1620, Detroit 1707, Kaskaskia 1712, Sault Ste. Marie and Mackinac 1751, Green Bay 1773, Superior 1807, and Prairie du Chien 1793.

The first definite reference to cattle is in 1820, at the time Cass, Schoolcraft and Doty visited the establishment. Besides a stockaded house and several out-buildings, they report some land in cultivation and also "several cows and horses, which have been transported with great labour." Doty reports the bringing of a horse from the Saulte in a bateau. (Fig. 2) Live-stock were again reported at La Pointe on Madeline Island in 1835, at the time of the changing of the headquarters of the American Fur Company from Mackinac to that place.

Grand Portage, on the north shore of Lake Superior, and Mackinac, both having had cattle before 1800, may well have been sources for these extensions. The first cattle taken up the Mississippi river into this section were from Prairie du Chien, near 1820[29]. Near the Red River of the North, the few animals brought over from Europe by the Scotch colonists had been destroyed. Following the transfer of several pairs of oxen and cows, a drove variously estimated from 200 to 400 were taken to the colony. Upon abandoning the colony, 1825-26, a number of these cattle were returned to Prairie du Chien. The cows sold at £4 to £10 each.

Descendants of the Cattle of the American Colonies In Wisconsin

American Background.

The progressively westward-moving cow country of North America provided the cattle for the second introduction into Wisconsin. These were descendants of the cattle of the colonists at Jamestown, and those of the subsequent New England, Central and Southern colonies of the Atlantic coast. The first cattle to reach the American colonies were brought by Sir Richard Grenville to Virginia in 1585, in an expedition sent out by Sir Walter Raleigh, but the colony perished, and the cattle were probably slaughtered by the settlers[30]. After several attempts that proved abortive, cattle were permanently established, at Jamestown, in 1610.

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[29] Minnesota History Collections, Vol. 3, p. 220. Also see Missouri Historical Collections, Vol. 3, p. 103, and Wisconsin Historical Collections, Vol. 18, p. 112, and Sec'y Treasury Report, Executive Documents, 1862. Contrast with Wisconsin Historical Collections, Vol. 20, p. 155.

[30] Morse, p. 227.

From the records it is evident that the cattle introduced at Jamestown were from the English breeds, with some mixture of Irish and Flemish cattle. In New York the cattle were largely of Dutch origin. The cattle in Pennsylvania were brought over by the Dutch and Swedish settlers. At Plymouth, the cattle were brought from Holland and England. The ships which arrived at Boston contained mostly English breeds, the Devon predominating. Into New Hampshire, Captain Mason introduced a large yellow breed from Denmark[31]. A mixture of all of these types, without selection or improvement eventually came to be known as the Native breed, or Native cattle. A description of these after 1800, when they had moved west of the Alleghenies is as follows: "They are a mixture of every breed, and the intelligent and observing breeder sees in them traces of almost all the English varieties, such perhaps as they were before science and attention had improved them, such as might offer to the American breeder the original materials of the most improved and valued stock, but requiring more time and perhaps more talent, skill and attention than the American farmer would be willing to bestow on the subject and yet necessary to enable him to arrive at the same results"[32].

After 1800 the cow country had reached the region west of the Alleghenies. The cattle of this New West may for convenience of discussion be separated into three sectors with definite physical boundaries; the northwest, central west, and southwest. Of these, the southwest, south of the Tennessee watershed, became of no importance to Wisconsin. It concerns the cattle taken to the west by the slave-holding planters. Next is the central west, which included Kentucky and Tennessee, regions which sent many cattle into Ohio, Indiana and Illinois. Finally, the Northwest, between the Great Lakes and the Ohio river, including as it does the cattle of Ohio, Indiana, Illinois, and Michigan, is of direct interest for Wisconsin.

Following French occupation in the Northwest Territory, the pioneer settlers from the American colonies brought cattle with them from nearby states: Pennsylvania, Virginia, and later, New York. The increase of these in Ohio made this the most important cattle raising country of the United States between

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[31] Bidwell, and Thompson both review these cattle, giving original sources.
[32] Bidwell, p. 224.

1815-1830. Indiana never became as important as Ohio, or Illinois, in cattle raising. The cattle history of Illinois is much a repetition of that of Ohio. The prairies were used for grazing rather than for farming until relatively late. The southern part of Illinois was settled first by Ohio river emigration[33], in a region in which the French had already extensively raised cattle[34]. Up to 1840 the chief movements of cattle from the early center around Kaskaskia were to the valley of the Illinois, to the prairies in the central part of the state, and to the north in the Fever River lead region, in the vicinity of Galena. This latter movement extended the cattle of the American colonies, now mixed with the French cattle, to the very edge of Wisconsin. Their start within Wisconsin was about the time of the Blackhawk war, 1832.

Cattle in Southwest Wisconsin.

The development of an early cattle population throughout Wisconsin closely parallels the early settlement of the state. Up to the end of the first quarter of the nineteenth century, the settlers were nearly all French-Canadian, or half-breed, and lived principally at Prairie du Chien or at Green Bay. The cattle of these settlements have been discussed. In 1825, the lead mines in the southwest corner of what is now the state of Wisconsin began to attract attention. Miners coming in induced hostilities with the Winnebagoes, who claimed the country containing the mines. United States troops readily quelled the disturbance and a ceding of this area by those Indians to the General Government soon followed. Up to 1831 the inhabitants were compelled to pursue the uncertain and precarious fortune of mining as a means of livelihood, the cultivation of the soil being expressly prohibited by the laws and regulations governing the mines. In 1832 the prohibition ceased to be enforced and

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[33] The following is a graphic sketch of a family floating down the Ohio on a raft: "To-day we have passed two large rafts lashed together, by which simple conveyance several families from New England were transporting themselves and their property to the land of promise in the western woods. Each raft was 80 or 90 feet long, with a small house erected on it, and on each was a stack of hay, round which several horses and cows were feeding." Belmont *Gazette*, Vol. 1, Nov. 2, 1836.

[34] Gould travelled in the west in 1849 and commented on the cattle of Illinois as follows: "The quality of the cows is of very little concern. I have seen, however, some of the finest cattle in Illinois that I have ever seen in my life, but in general a more ill-looking, black, ring-streaked and speckled race have never been known since the days of the patriarch Jacob."

the country began to hold out more inducements to general immigration.

A traveler in the lead region of Wisconsin, in 1832, just following the defeat of Black Hawk and the removal of Indian troubles, spoke of the farming thus: "Occasionally a farm might be seen running out from an island of timber, and supplied with comfortable buildings but most of the improvements were of a temporary nature, consisting of a lead furnace and cabins adjacent."

An instance of early settling in the lead region was that of the Parkeson families[35]. These farming families, of English descent, were originally Virginians, moving to Tennessee soon after the Revolutionary war. About 1810 the families moved to southern Illinois. In 1827 the Col. D. M. Parkeson family removed to Wisconsin where Col. Parkeson engaged in the mining business at New Diggings, La Fayette county. In speaking of this region he says the newcomers were so intent on making money by mining that they could not take time to erect for themselves and families even a comfortable dwelling place; instead of houses they usually lived in dens or caves, a large hole or excavation being made in the side of the hill or bluff, the top being covered over with poles, grass and sods. In 1833, after the removal of the farming prohibition, the Parkeson family removed to a farm near Mineral Point. This family induced the J. B. Parkeson family to move to Wisconsin from Illinois, in 1836, the family bringing horses, oxen and cows.

Other accounts show that droving of cattle from southern Illinois was being practiced. Droves of cattle were taken up along the Mississippi as far as Fort Snelling. The Post at Prairie du Chien being close to the cattle area advertised for proposals for fresh beef (slaughtered weekly, or semi-weekly, as desired) in the Galena newspaper[36]. The need was estimated at 40,000 pounds per year. The town of Prairie du Chien, which contained about 100 houses by 1840, secured much of its supplies from some 40 farms on Blake's prairie, south of the Wisconsin river.

On the north side of the Wisconsin river a settlement was started at Prairie du Sac, or Sauk Prairie, in 1838. The letters

[35] W.H.C. Vol. 2, p. 332, Vol. 4, p. 94.

[36] *Northwestern Gazette* and *Galena Advertiser*, Vol. 1, No. 4.

of Jakob and Ulrich Buhler[37], furnish an interesting account of the bringing of cattle to this region in 1842. This Swiss family with their nine children moved, via Galena, to the town of Honey Creek, Sauk county, and took up a homestead there. The trip was made with a large company of Swiss people who made up a caravan party. The party was led by a French guide who furnished ox carts for the hauling of baggage, small children and the sick. A number of cattle were driven along and supplied fresh meat. Within the next few years but few cattle were raised as there was at that time no market other than for personal or local use, without long overland driving.

The situation for southwest Wisconsin has been summarized by Brunson in writing for the Wisconsin State Agricultural Society in 1851. He states: "The cattle of this section originally came from Illinois and Missouri and were not of the first quality. Some few of a good quality were obtained by the droves brought up but generally of ordinary character."

Descriptions of cattle in the lead region of Wisconsin have been secured from the advertising of lost and strayed animals in the Mineral Point Free Press, and the Wisconsin Whig, Platteville, 1842-1843. These show the animals to have had little uniformity. Brindle and white-spotted cattle were the most numerous. For instance, five dollars reward was offered for the following strays from Platteville, 1842: "One pair of oxen, about 10 years old—description as follows: one of them is a brindle color, partly white, a little white on his back—horns widespread and high, some white on his flanks and his left eye is out. The other is a line black, with his sides, neck and head speckled with white, red, black and some rather blue spots—his left eye is also out".

Droving to Green Bay.

Of the eastern part of Wisconsin a writer of 1835 states: "Three years ago on the whole route from this place [Green Bay] to Chicago there was but one house and the journey required the preparation of a month. It was Indian territory and none but Indians and Voyageurs had the hardihood to attempt the trip." The Milwaukee trading post was the one house. Southern Wisconsin was described as a splendid waste, with no marks of civilization or cultivation.

[37] W. M. H. Vol. 6, p. 327-334.

Droving of cattle through the eastern part of the State to Fort Howard, the Post at Green Bay, had been in progress a number of years. The first reference to this[38] is only an incomplete account from a manuscript dated 5 January, 1820, and is as follows: "Toward the close of November a herd of cattle, for the Assistant Commissary at this Post, having arrived within two days march, the drover near Manitouwalk [Manitowoc] upon the Shore of Lake Michigan, was attacked by several Indians, robbed of his Portmanteau, etc., and one of the cattle taken from him and killed. Several Soldiers were employed in conducting these cattle, but the drover at this time, had fallen some miles in the rear, with a view to bringing up such as had strayed behind when the Indians had availed themselves of the opportunity, thus presented, to plunder him as above."

A more complete account of an early drive, showing the origin of the cattle, is from the personal narrative of the drover, Col. William S. Hamilton[39]. It is in part as follows: "Colonel Hamilton says, that he started from Springfield, Illinois, for Rock Island, in May 1825, to attend to some business there. After having attended to it he started back for Springfield. When he reached the Mackinaw River, he met a drove of cattle belonging to him, which on leaving Springfield for Rock Island he had ordered to be sent to Green Bay, he having a contract to supply the fort at that place with cattle. On reaching the Mackinaw he found that the drove had been crossed over, but that in effecting a passage, a man had been lost by drowning, the river being very much swollen. The party with the cattle being discouraged, the colonel decided at once to accompany them himself to Green Bay. He crossed the Mackinaw at Dillon settlement[40]. He left the Mackinaw for Green Bay some time early in June with four men and about seven hundred head of cattle. His route from the Mackinaw was to the Illinois at the mouth of the Fox River of the Illinois. At that time there was no settlement between Dillon's, on the Mackinaw, and Chicago, except on a stream called "Nine Mile Creek", a stream between the Mackinaw and Vermillion. William Holland was living where he crossed Nine Mile Creek; Holland had been the Indian Blacksmith at Peoria.

[38] W. H. C. Vol. 20, p. 140.
[39] Smith, the History of Wisconsin. Vol. 3, Pt. 2, Documentary, Madison, 1854.
[40] Tazewell Co., Illinois.

"At the mouth of Fox River of the Illinois, he found some Potawatomies; he crossed the Illinois just above the mouth of the Fox; the river being high it was necessary to swim it. His cattle had cost him on an average less than ten dollars a head When he arrived at Chicago he found the fort was not occupied by troops, but was under the care of ------ Forsyth, the Indian agent. He there met with Colonel Beaubien and ------ Crafts, of the American Fur Company. In crossing the Chicago River, Colonel Beaubien's brother, in assisting the passage of the cattle contrived to drown one of them, so that they might have a chance to buy it as he afterwards (in 1836) told Colonel Hamilton; knowing that Hamilton would not sell, as his cattle were contracted for, by the government. He also met at Chicago with Dr. Wolcott who was married to a daughter of Mr. Kinzie. He also met there with Lieutenant Helm, formerly of the United States Army, and his wife; Helm was one of those who were saved at the Chicago massacre. He also found there a Frenchman named 'Ouillimette' who had a farm on the Chicago River. From Chicago to Gros Pointe he followed up the Lake, though not immediately along the shore. Not far from Gros Pointe, on a level and not elevated piece of ground, were the remains of an old fort, called at that time 'Little Fort', the site perhaps, or the town now called Waukegan. From Gros Pointe to Milwaukee, he followed mainly the shore of the lake; there were no white inhabitants between Chicago and Milwaukee; they passed some few Indians, but no Indian Villages.

"On reaching Milwaukee he found but one solitary person there, ------ Solomon Juneau. He was entirely alone—he had not his family with him—there was not even an Indian there. Colonel Hamilton thinks he recollects that Juneau told him that some persons had gone off for provisions. James Kinzie [note—of Racine] had a trading house on the south side of Milwaukee River, but at that time it was not occupied. Juneau had a trading house on the north side of the river. There were no other persons having houses there at that time. He found Juneau nearly starved out, and delighted to see him and his provisions. Mr. Juneau at that time was an engagé for the American Fur Company.

"Colonel Hamilton kept up the lake from Milwaukee to Manitowoc; between the two places he found Colonel Ebenezer Childs, afterwards a member of the Legislature from Brown

county, with a party of men, with a seine, and a Mackinaw boat fishing for white fish; Childs and his party were from Green Bay; there was no settlement between Milwaukee and Manitowoc. At Manitowoc, they left the lake for Green Bay; the first house they reached was at Duck Creek, where there was a saw mill, about four miles from Green Bay. [Note—he means Manitou River].

"At Green Bay was Fort Howard, garrisoned by a regiment of troops under the command of Major Whistler; the town of Green Bay was then mostly occupied by the French. There were some Americans there, but four-fifths of the people were French. Of the Americans then there were Arndt, Lawe, and the Irwins. Colonel Brevoort was Indian Agent.

"Colonel Hamilton arrived at the bay about the twenty-seventh or eighth of June; by his contract he was to be there with his cattle on the fourth of July. He remained there until the sixth or seventh of July, when he took the back track to Milwaukee. There was an Indian village at Manitowoc, or Twin River, of different tribes. On his return to Milwaukee he found Juneau, a few other Frenchmen and some Indians. At Milwaukee he left the lake, and followed an Indian trail south westerly and came upon the Illinois somewhere about Mount Joliet. From thence he kept down the Illinois to the Mouth of the Fox River where he crossed it and thence went back to Springfield by the usual route."

It was on this trip that Colonel Hamilton first set his foot in Wisconsin; he lost none of his cattle except one purposely drowned in the Chicago River. (Fig. 3)

Another pioneer drive of cattle to Green Bay (Fort Howard) from southern Illinois was made in 1827, by Col. Ebenezer Childs. "262 head were purchased around Carrolton at $2 per hundred, and $5 to $7 apiece for the cows". This drive, as with that of Hamilton, went up the Lake Michigan shore. By 1830, the whole quantity of land cleared and under any kind of cultivation at Green Bay was estimated at 2,500 acres. The great bulk of the wheat being raised by the inhabitants was used for feeding cattle, the flour required for the sustenance of the population being brought principally from the mills in Ohio, bordering on Lake Erie[41].

[41] Green Bay *Intelligencer*, Vol. 1, no. 2, p. 1.

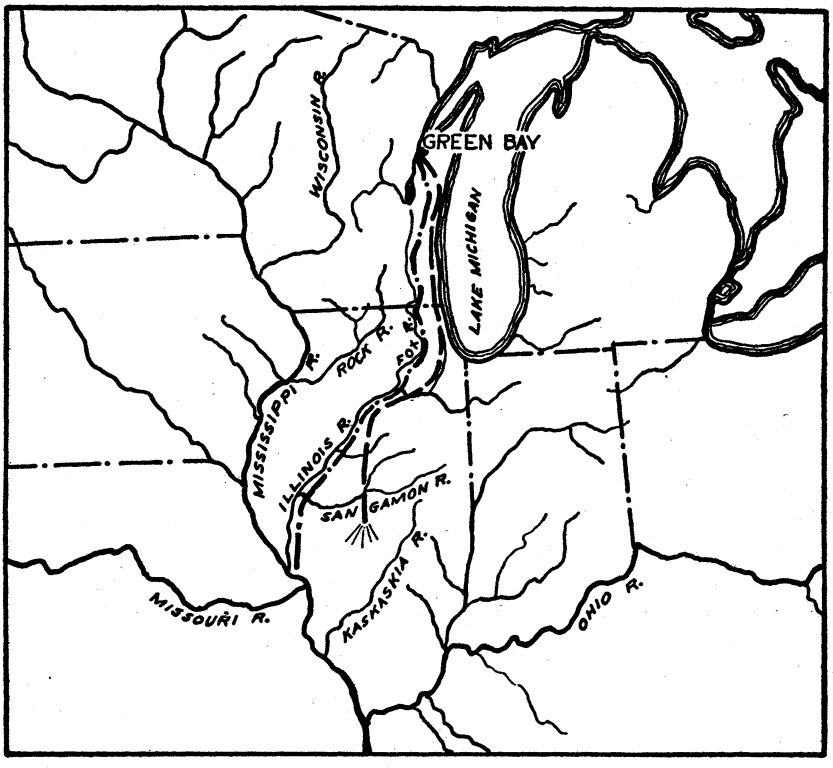

FIG. 3. *Early Droving Routes to Fort Howard, Green Bay.*

— — — route of Hamilton.
— . — route of Child.

Cattle in the Settlements in Southeastern Wisconsin.

Other than these occasional droves of cattle, there were no cattle in southeastern Wisconsin until about the time the lands were being surveyed and the Territory of Wisconsin established. By 1836 cattle were in the settlements at Skunk Grove, in Racine County, and in the Rock River settlements, Rock county. In the Fox river (Wisconsin) valley, Edwin Bottomley, a leader in the English settlement[42] secured his first cattle in 1842 from a drover. At that time a cow and a calf cost him $15, and a cow and an "Efer" $15. In this settlement the cattle were allowed

[42] W. H. C. Vol. 26, p. 32.

to run at large and the crops were fenced in. In 1844 he was milking four cows and states that he would buy more if they were to be sold.

For the story of a community, Jefferson county is considered. One of the first records available in this county is for Aztalan[43] where it is recorded that in 1838, at a meeting, the thirty oxen of the settlement were counted up and an estimate made as to how long the band of settlers could subsist on them in case they were reduced to that extremity. Near Rock Lake there is recorded a more complete story concerning Mr. A. Pickett and family[44] who removed from the State of Ohio and settled near Rock Lake, in the town of Lake Mills, in 1840. But few pioneers had preceded Mr. Pickett to this place. The grass which was growing over the openings and lower marsh, and which "had millions in it" was, for the lack of cows to convert it into milk, being consumed by fires, which had for centuries swept over the country. Mr. Pickett had driven from Ohio ten cows, and although he desired more for a cheese making enterprise, there were none to be bought at any price. Four neighbors together had ten cows which were enlisted in the enterprise and another ten rented from Aztalan. Two more settlers and five cows arrived in 1842. The cows grazed together in one herd, and at night all were driven to one yard and milked by their respective owners.

For cattle in a later community the Swiss colony at New Glarus may be considered. Here in 1845, upon the arrival of the colonists, breaking of the land was slow and laborious as teams and plows had not yet been obtained. Most of the first breaking was done with spades and shovels. Sometime during the spring of 1846, drovers from Ohio brought a lot of cows to Exeter, a mining town eight miles east of New Glarus. The colonists hearing of it, at once set out to purchase some; and being excellent judges, selected the best animals of the herd in sufficient numbers to give each family one. These cost $12 a piece and were paid for out of a general fund for aid. As the year advanced four yoke of oxen were purchased for the common use of the colony. They were used in turn, by each family, for breaking up land, drawing wood from the timber tract, or anything else necessary to be done. After one person had used the

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[43] W. H. C. Vol. 11, p. 421-422.

[44] Jefferson County *Union*, Vol. 8, No. 51

yoke of cattle the allotted time he turned them over to the next on the list entitled to use them. The oxen were reported to have had as hard a time as any of the colonists. In 1849, the stock of the colony included one bull, forty-one oxen, forty-nine cows, forty two-year-olds, and fifty-one calves. The colony population was one hundred twenty-five.

Schafer summarizes the situation for southeastern Wisconsin by saying that the people in the older settlements of Illinois and Indiana were always interested in the marketing possibilities of the new northern settlements and brought in herds of stock cattle, droves of hogs and flocks of sheep. The cattle served for work oxen, milch cows, and stock cattle. It was thought that a majority of the herds of southeastern Wisconsin, in 1850, could be traced to such importations. As yet, practically all of the people dwelt south of the Fox-Wisconsin waterway[45].

Descriptions.

If one is to accept the early history of American cattle as it has been written, there were, except in a few instances, no attempts to improve the stock by selection in breeding as it moved westward; often the likeliest animals were sold to the butcher. Descriptions of these cattle soon after they had reached Wisconsin have been secured through early Wisconsin newspaper notices. The Wisconsin newspapers started with the Green Bay Intelligencer in 1833. The early issues of the following papers were consulted: Green Bay Intelligencer, Green Bay Free Press, Milwaukee Advertiser, Belmont Gazette, Wisconsin Democrat, Miners Free Press, Wisconsin Territorial Gazette, Burlington Advertiser, Wisconsin Enquirer, and Wisconsin Whig.

The notices were infrequent. However, thirty-one individual descriptions were secured and their color relationships are presented in Table I. A lack of uniformity is evident. Other than is shown in the table, the red and the brindle cattle ranged from black-red to dun and light red. No uniformity of horn shape or size was found. Marking by cropped ears was the usual practice rather than branding. The high percentage of brindle cattle is interpreted as due to the influence of the cattle of French importation; the red to the admired Devon stock. In no instance was a breed name used in connection with the identifying terms.

[45] Schafer, p. 71.

Table I. Color types of Cattle in Wisconsin 1834-1844.

Percent	Color Type
36	brindle
19	white face
26	red (some white)
13	white (principally)
6	black (principally)

Improved Cattle in Wisconsin

American Background.

In America the leadership in the improvement of cattle came from a few wealthy men who made a hobby of progressive farming[46]. Their attention was directed to the new importation of representatives of English stock rather than to the betterment of the native, or common, animals by selective breeding. By 1840, representatives of all the important English breeds had been introduced into the eastern states, including Herefords, North Devons, and Shorthorns. The Channel Islands were represented by Alderneys and Guernseys. The efforts of cattle breeding enthusiasts in this period were directed chiefly to the building up of herds of pure-blood stock, and the improvement of pure-blood stock. The improvement of native stock by judicious crossing of breeds seems to have hardly begun before 1840[47].

The first improved English cattle to cross the mountains were those taken by members of the Patton family from Virginia to Kentucky about 1795. A few years later representatives of this stock were taken into Ohio, where they soon gained a wide reputation. They were large animals, coarse and rough, with long widespread horns, probably of the Lancashire or Bakewell breed. In 1817, the first importations of Shorthorn stock arrived in Kentucky[48]. These cattle proved a valuable acquisition to the existing stock of the country, though the quality of their

[46] "A few English Cattle were brought to this country before 1800, probably of the Lancashire or Bakewell breed, but the period of greatest activity dates from about 1820. . . . They were kept with great care by their owners and exhibited frequently at the annual cattle shows, where they attracted much attention. Auction sales of pure-blood stock were social events in the neighborhood of Philadelphia and New York, where distinguished city folk vied with one another in paying high prices for animals of exceptional pedigrees." Connecticut State Agricultural Society Transactions, 1854, p. 99.

[47] *Ibid.*

[48] American Farmer, 2, p. 313; 4, p. 233-280.

beef was perhaps not better than the Patton or Miller stock, nor were the cows better milkers. Although the new breeds were known in Indiana and Ohio as well as in Kentucky, there was little general interest among the farmers in stock improvement by importation. The English cattle were considered too "fancy" for the average farmer.

The organization in 1834 of the Ohio company for importing English cattle marked the beginning of a new stage in the betterment of Western livestock. Heretofore importations had been sporadic, depending on the whims and financial means of the gentlemen farmers. The new company, with a capital of $9,200, subscribed in shares of $100 each, sent agents abroad who selected and brought to Ohio 19 head of thoroughbred Shorthorn, or improved Durham stock, from the herds of the most celebrated breeders. The cattle were kept together under the care of an agent and their number was increased by later importation until 1836, when they were sold at auction and scattered extensively over Ohio. In 1837 another large importation was made and sold by the same methods[49],[50]. The first of the registered Shorthorns in Wisconsin trace both to these importations and to the 1817 Kentucky importation.

Early Improved Cattle in Wisconsin.

The first reference to improved cattle that has been found for Wisconsin is in a letter written by Mr. Briand, Brown County. After referring to a drove of cattle taken from Illinois to Green Bay by Colonel Tuller, in 1836-7, which, according to Mr. Briand, subsequently become the basis of most of the best cattle in that section, he gives an account of the Hon. M. L. Martin, who, in 1838 obtained and brought to what was later Brown county, a full-blood Durham shorthorn bull. This bull was kept for five years. The benefits resulting from Mr. Martin's enterprise were distinctly visible, many of the cows from his stock being excellent milkers and in form and symmetry showing their origin.

For a number of years more interest was shown in the care and improvement of the cattle of Green Bay than in any other section of the State. Farmers began to fence off their pastures, and became interested in securing more butter from their cows.

[49] Ohio State Board of Agriculture, 12th. Ann. Rpt. p. 301.
[50] Maine Board of Agriculture, 19th Ann. Rpt. 1874, p. 140.

It was predicted that stock raising and its concomitant pursuits would unquestionably become a leading business in the community. In 1844 the Green Bay *Republican* printed the following from the Guernsey Agricultural Society:

"Points of a Good Cow

1. Purity of the breed and qualities of the dam for yielding rich and yellow butter.
2. Small head, large and bright eyes, small muzzle, small ears, orange color within.
3. Straight back from the shoulders to the tail and chest wide.
4. A fine and loose skin, with soft and short hair.
5. Sides well rounded, flank small between the side and paunch.
6. Fore-legs straight and well proportioned, hind-legs broad above the knee, fine and clean below, hoofs small; legs should not cross in walking.
7. Udder large, and the teats large, and springing from the four corners of the udder; milk vein large and well defined."

A general interest in the improvement of cattle was evident in the State about 1850, following several years of partial crop failures. The *Wisconsin Farmer and Northwestern Cultivator* reflected the spirit of the times in the following article: "We have observed since we have been residents of Wisconsin, that the energies of the farmers are largely expended on wheat. During most of the time, the price has been low, and if at any time the article bore a fair price the cost of transportation consumed all possible profit. At the same time, we are exporting from the east articles which we could better raise here at home. The most costly of these are sheep, cattle, and dairy products. We are annually paying large sums for these, thereby rewarding the interests and enterprises of other states when we have every facility for raising them at home"[51].

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[51] *Wisconsin Farmer*, 1, p. 254.

At this time a fairly good grade of oxen, showing much Devon blood, began to come in from New England and other Eastern states[52]. Devon and Durham cattle became common topics of conversation, and made up the majority of the cattle at the State and at many of the county fairs. The lack of uniformity of these cattle was frequently commented on by the judges at the State Fair, as for example: "there was one feature in the Durham cattle obvious to the most casual observer and which ought not to be passed over in silence, viz: a great lack of uniformity, not in color merely, but as much difference in style and points, as between animals of different breeds, and this was observable, too, in animals of the same herd. Now it is presumable that every [breeder] of blooded stock has some definite object in view, a type of perfection either real or imaginary as his aim; and when he exhibits two animals perfectly dissimilar, it is evident in one instance that his pursuit has proven a failure. Nor was this lack of uniformity confined to the Durham breed, for the six aged Devon bulls on exhibition, with the exception of color, no two of them were sufficiently alike to have made a well matched pair of cattle . . . the only class of Devons in which there was any competition, an agreement of the committee was an utter impossibility. One—it may be—esteeming size and weight; another fineness with the muscle of the blood horse; another, symmetry with the beautifully turned points of the Durham as the sine qua non of a Devon bull; each of which ideal animals was represented in the select specimens before us"[53]. Although few of these progressive farmers became famous as breeders, the animals they brought played an important role in breeding up and improving the native stock of the state.

Early Herds of Registered Cattle.

The first breeding herd of registered Shorthorn cattle of note in Wisconsin was that of Charles H. Williams, Baraboo, Sauk county. Mr. Williams was a native of Ohio, coming to Wisconsin early in the fifties. His first registrations appear in Volume II of the American Herd Book. Fig. 4 shows the registered animals of his herd. These trace to both the early Shorthorns of Ohio, and in the instance of Paris 1995, to the original '17's of Kentucky.

[52] *Wisconsin Farmer*, 4, p. 166.

[53] The Wisconsin State Agric. Soc. Transactions, 1854-7 p. 435.

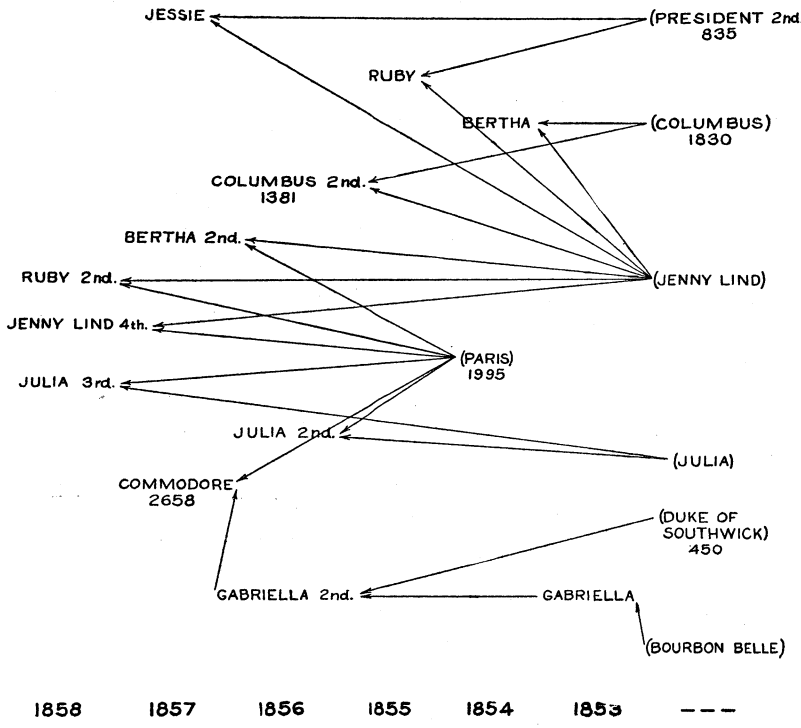

FIG. 4. The animals and their relationships in the Charles Henry Williams herd of Shorthorn cattle, *1850-1860,† with birth years below.

Another breeder who played an important part in the development of the Shorthorn industry in Wisconsin was John P. Roe of Muskego, Waukesha County. Mr. Roe came to the state directly from England in 1854, bringing Shorthorn cattle with him from the herd of George Faulkner of Rothersthorpe, England. Fig. 5 shows the first animals of this herd.

The Shorthorn, as started by these breeders, reigned supreme between the years 1850 and 1880. Many of the herds improved by Shorthorn animals were the foundation herds upon which the dairy breeds were crossed. After 1890 the Shorthorn definitely gave way to the dairy breeds.

The start of Wisconsin's purebred, later registered, dairy breeds is to be credited to the 1850's. These were Alderney (la-

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* indicates that the animal in question was brought into the state.

† Volume V of the American Herd Book was not available.

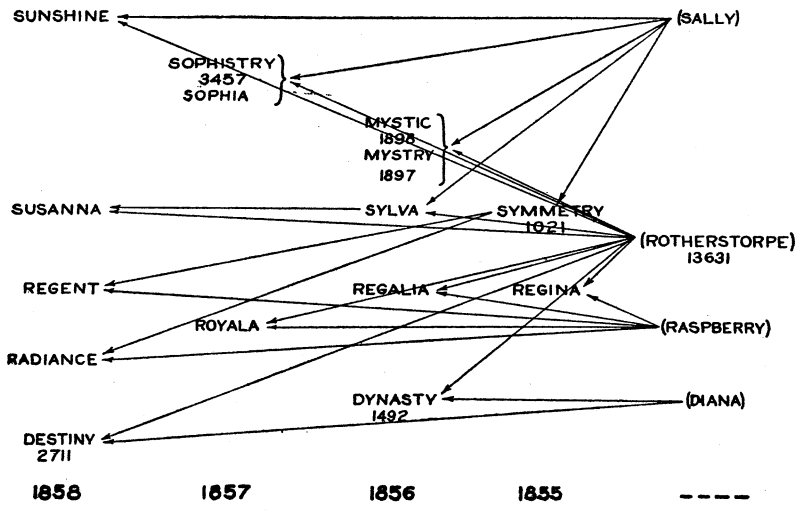

FIG. 5. The animals and their relationships in the John P. Roe herd of Shorthorn cattle, 1850-1860, with birth years below. (See footnotes, p. 159).

ter registered Jersey) cattle in the pioneer herd of J. V. Robbins, Dane County[54].

The following statements from the records of the American Jersey Cattle Club records show the registry of Robbins' Major and Bonamy, two of these early cattle, and is included for its historical value: "The sire of Mendota was Robbin's Major 8310, dropped April 16, 1857; bred by Thomas Motley, Jamaica Plain, Mass., and registered by T. L. Haecker, Dec. 2, 1882, in the name of Simon Ruble, Beloit, Wis. The transfer record shows that this bull went from Thos. Motley to J. V. Robbins, Boston, Mass., July 31, 1857; from Robbins to J. W. Harvey, Madison, Wis., September, 1863; and from Harvey to Simon Ruble, Beloit, Wis., in the winter of 1866.

"Robbins' Major's sire was Major 75, and his dam was Flirt 326. Major's sire was Colonel 76; his dam was Countess 114. Flirt's sire was Colonel 76, and her dam was Flora 113. All these were imported in May, 1851, by Thomas Motley, of Jamaica Plain, Mass.

"Bonamy 10705, the dam of Mendota, was imported in dam, by S. S. Spaulding, Boston, Mass., and B. D. Godfrey, Medford,

[54] Wisconsin State Agricultural Soc. Transactions, 1860.

Mass., on Sept. 24, 1852, and dropped in the fall of 1852. Her dam must have been sold to C. W. Webster, Boston, Mass., as she was registered by him on Sept. 8, 1880. Neither her sire or dam was given, as Webster lost all his herd records in the great Boston fire. Bonamy was sold by Webster to J. V. Robbins, Madison, Wis., in June, 1858, and transferred from Robbins to A. G. Darwin, Madison, Wis., in July, 1863. She was registered to make her daughter Mendota eligible."

Through Mendota 17910, Mendota 2nd, 26326, and their mating with Omaha 482, this early start formed a permanent foundation for Jersey cattle in Wisconsin.

Stock Raising from 1860 to 1890.

The period 1860-1890 starts with a growing interest in stock raising, although the number of cattle even declined during the first few years. The raising of wheat had reached its culminating point between 1850 and 1860. The pioneers who had the courage to break away from the old routine and lay the foundation for many years of profitable agriculture, selected dairying for a regular business. In many instances improved feeding was the means to more profit in the specialized practice. Cheese was the outlet for production and such was the use of whole milk for this purpose that calves were not raised in many instances. Specialized breeds became more frequent and improved cattle were added to the formula for profit making. The battle between the beef, dual-purpose, and dairy breeds was fought vigorously. The Jefferson County *Union,* now an important voice for the dairy interests, promoted the specialized dairy breeds intensively. Breed interest became more and more evident. More and more registered herds were established, and sires of the new breeds used for general herd improvement. The Jersey came early and was used, and promoted, as a producer of butter. The Ayrshire had an early wave of popularity, and was then frequently supplanted by other breeds. The Holstein and later the Guernsey were used extensively for general herd improvement, although the latter was first put forth as a family cow. Butter and later whole milk were added to cheese as an outlet for dairy production. Seed stock were sold to neighboring states, particularly Iowa, and states to the west. The Babcock test, the silo, the breed organizations, as well as cooperative ventures in

the latter years of this period, all contributed to the formation of a mammoth, specialized industry. The registered breeds formed the fountain head.

The Period 1860-1870.

Evidence for the growing interest in the cattle industry for the period 1860-1868 is shown in the report of the Secretary of the Wisconsin State Agricultural Society. "Thorough-bred animals of every class are becoming much more common than they were five years ago, and their influence upon the native or common stock is already very observable. In view of the marked adaptability of our State to their production, this advance in the right direction is an especial ground for hearty congratulation. . . . Cattle breeding does not yet receive its proportionate share of attention. Returns show even a diminuation in numbers from 1860 to 1866 in the proportion of 554,203 to 413,459. This falling off, if it has really occurred, is probably owing to the extra attention concentrated upon wool growing and other branches of farming during that period. The Durhams and Devons still are, as they must continue to be,—until some entirely new breed is developed,—the favorite breed; the former having no rival for beef and the latter none for work. There are also a few small herds of Alderneys and Ayrshires, but as yet their influence is hardly perceptable."

The report speaks of the almost entire immunity of all classes of Wisconsin stock, during the year, from the various diseases which had been so destructive in other portions of the country. "In this particular, our State has for many years, been highly favored. Indeed it has never been visited by any of the sweeping epidemics, like hog cholera, murrain, pleuro-pneumonia, abortion in cows, the Texas cattle disease, from which many of the other states have more or less suffered." It is also said that: "The conviction is yearly becoming more general among our farmers that there are definite principles of breeding, which it is necessary to understand and observe in order to [obtain] the best results: and the number correspondingly increases of such as are willing to make large expenditures and sacrifices, in order to insure their flocks and herds the best conditions of success. So that, not only in fine-wool sheep—in which we have, for sometime, held rank among the foremost of the wool producing states —but also in the qualities of our horses and cattle, we are quite

rapidly approaching a time, when the Wisconsin farmers will be able to show stock with even the foremost breeders in the older States. Our fairs, State and County are doing much to advance this interest, by bringing the best animals to the notice of many communities, by encouraging the owners of valuable stock bred in the neighboring states to bring it among us, and by stimulating many spirited breeders to import even from foreign countries."[55]

A statement from the State Fair of 1870 gives a general picture. "The classes comprising the various breeds of neet stock were well sustained by farmers of the State. . . . The Shorthorns, as usual, were far more numerous than any other breed; next, in point of numbers, came the Devons; then the Alderneys and a small representation of Ayrshires. The two last named showing a better class of cattle than have been exhibited heretofore. . . . Breeders of thoroughbred stock have, for the past few years, shown a very commendable emulation, and great enterprise in bringing into the State so many valuable breeding animals. These breeders have done much towards advancing the general prosperity and it now becomes the duty, as it is in the interests of the general farmer, to make use of the advantage brought to his door, and to proceed without delay to improve his native stock, step by step, until they become paying property, and a credit to the grower, his country and the State.

"The show of milch cows was meagre indeed (altho the few animals exhibited were good), not such as it should have been when we consider how important and valuable that interest has become. The dairy farmers are not sufficiently alive to their own interests and that of the State when they neglect to represent themselves in a credible manner at our annual exhibitions of improved stock.

"The exibition of grade cattle and working oxen was slim in point of numbers, and not as good in quality as it should have been. With the fine show of thorough-bred Shorthorns and Devons to be seen at our annual exibitions for several years back, made up of choice stock from all parts of the State, it would be reasonable to suppose there would be a very large increase of improved grades, and better shows at our annual exibitions. But it seems our farmers have not realized the great

[55] W. S. A. S. Trans., 1869, p. 36.

benefits to be derived from crossing the native cow with thorough-bred males. For at this time, improved grades are so scarce that persons engaged in stall feeding, are obliged to go to adjoining states to procure stock for feeding purposes, having learned by sad experience that money cannot be made by feeding native stock."[56]

"It was said that farming is, and must continue to be the chief object of industry and the foundation of a large share of the wealth of the people of the State; it is encouraged by State grants of money, in various ways, by aiding Agricultural societies, published agricultural reports, collecting statistics; and recently by the establishment of an Agricultural college as part of the State University. About one-half of the land in Wisconsin still remains in the hands, either of the United States, or of the State government and subject to entry by any person at anytime, at the most moderate price. The whole number of farms is estimated 100,000 with an average of 40 acres each, in all, four million acres under actual culture. This shows a surplus of over thirty millions of acres uncultivated or about seven eighths of the whole land of the State."[57]

The Period 1870-1880.

The year 1870 marks the starting of a small paper at Lake Mills, called the Jefferson County Union, which from its first issue, March 17, of that year began to urge the farmers of Jefferson county to organize themselves into cheese factory sections. One reaction involving the cattle of the state is shown in the report of Hoyt, 1870: "It seems that our farmers being within range of the Cheese factories are so anxious to turn their milk into money that they are in the habit of killing off their calves at a day old, or at latest as early as their hides will be salable. This naturally diminishes the supply of cattle and calves for the butchers and raises the price of meat in the local market; and this demand in turn results in the slaughter of large numbers of young cattle of all ages."[58]

A statement of Hoyt in reference to breeding is as follows: ". . . No intelligent farmer any longer questions the possibility of greatly increasing the milk-producing qualities of his cows by

[56] W. S. A. S. Trans., 1870, p. 152.
[57] State Board of Immigration, 1869.
[58] W. S. A. S., Trans. p. 41, 1870.

breeding in reference to it; and yet, so far as we have observed, but comparatively little attention has been given to this matter. The Ayrshires are universally acknowledged to be the best milkers—at least if we regard quantity, and they also yield a good quality milk—and yet we know of but two or three small herds in the whole state. If there are unsurmountable objections to the introduction of this breed we have yet to learn what they are."

This period also marks the formation of the State Dairyman's Association. "The Jefferson county Dairyman's Association and a similar organization in Fond du Lac county had been organized the year before. The first move made towards forming a Wisconsin Dairymen's Association originated in a motion to that effect, by the editor of this paper, in the Jefferson County Dairyman's Association, Jan. 26, 1872, and we were instructed to prepare a call for a meeting to form such Association. The call was signed by S. Faville, W. D. Hoard, J. G. Hull, Q. C. Olin, Chas. Copeland, of this county; F. E. Morrow, Editor *Western Farmer,* Madison, Chester Hazen President and H. Strong sec. Fond du Lac Co. Dairymen's Association. The first meeting was held in the Lindon House, Watertown, Feb. 15, 1872. But few persons were present, a constitution was adopted and the following officers elected: President, Chester Hazen, Ladoga; Vice Pres. H. F. Dousman, Waterville, and H. C. Drake, Lake Mills; Sec., W. D. Hoard; Treasurer, Walt. S. Greene, Milford. The influence yielded by the association thus formed, upon the agricultural prosperity of Wisconsin has been immense."[59]

[59] Jefferson County *Union*, Vol. 9, 1879.

Types of Herds and Their Management.

One of the great promoters of good feeding of dairy cattle in the next few years was Mr. Wm. C. White of Kenosha, who at the time said: Feed a cow only four quarts of bran shorts, and meal per day, and you can hardly see any good results; feed her eight quarts and she will increase her mess of milk, so as to pay down every day for what she eats; feed her twelve quarts and she will make a surplus for clear profit.[60]

"An interesting statement regarding this very successful and veteran dairyman is the following: 'I always speak to a cow as

[60] Jefferson County *Union*, Vol. 8, 1878.

I would to a lady', which contains volumes of meaning. It means the kindest and most considerate care, the most generous and thoughtful regard for the comfort and content of the animal which in turn is to yield him such splendid results as 650 lbs. of cheese per cow in one season, from a dairy of 70 cows. Mr. White's farm consists of 384 acres of fine prairie and openings soil, about two miles from Mr. Simmon's farm, on the edge of Pleasant Prairie. He commenced dairying in 1857. He started the first cheese factory in southern Wisconsin. His herd consisted last season, of 75 cows mostly of Durham and Ayrshire grades, with 14 full bred Ayrshires. He has great success as a raiser of good cows and his maxim is: 'Commence when they are calves and never let them stop in growth.' He is a very heavy feeder, raising a half acre of corn to the cow besides purchasing large quantities of bran. We heard him asked once in a conversation if he thought such heavy feeding paid the expense, with a twinkle in his merry old eye, he replied 'I commenced poor and all that I am worth I owe to the cow.' . . . He stated to us that he believed he could select forty cows from his herd which would yield an average of 800 lbs. of cheese each, in a single season. His dairy is one of his own breeding and shows the value of care and attention in this particular."[61]

At this time the owner of the largest herd of cows for dairy purposes in the state was Mr. Z. C. Simmons, President of the Northwestern Telegraph Co.; and also President of the Wisconsin Dairymans Association, 1879. "The total number were three hundred and fifty. In this instance two large farms were brought into requisition lying two miles apart, with most perfect appliances and buildings upon each. The first was known as the Somers farm and consisted of eight hundred acres of splendid prairie soil. One hundred fifty cows were kept on this farm. The second farm was known as the Prairie Farm and was a portion of the famous old Truesdale Farm, which, before the buildings were destroyed by fire, was considered the most elaborate and finely appointed farm establishment in the United States. This farm contained about fifteen hundred acres and supported two hundred cows. The amount of cheese made on the Prairie Farm in 1878 was 110,000 pounds, or an average of

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[61] *Ibid*, Vol. 9, 1879.

550 pounds per cow. The cows were fed twice a day with corn meal and bran."[62]

It has been said[63] that one of the most important breeders of this period was Mr. C. H. Williams. The breeding of thoroughbred Durham or Shorthorn cattle was the branch of Mr. William's farming to which he devoted the greatest amount of labor and conscientious care, both at Meadow Farm at Ableman and at Elmwood Farm at Baraboo, beginning at the latter place in 1871. "At Elmwood Farm he introduced and carried on a system of public sales of Shorthorns that brought together farmers from various parts of the State. At this time, 1879, he was the veteran breeder of the State, having bred them since 1853. The beginning of this herd and all new additions came from Kentucky, except a later purchase from the herd of George Murray, of Racine, and one from W. B. Dodge of Waukegan, Illinois. His herd was subject to some criticism in that it lacked the blood that would command the highest prices. His animals, however, were just the type that were needed in Wisconsin; that is, well bred animals, of good quality which could be purchased at prices favorable to the general farmer and to the small breeder. During all his years of breeding, Mr. Williams had been tireless in his efforts to impress upon the livestock breeders of the State the advantage to be derived from good cattle. To quote Mr. Williams: 'Farmers of Wisconsin, our interests and those of our state lie largely in improving our domestic animals, growing the best of its kind is the most profitable. Raise then only the best—the best cattle, the best sheep, swine and poultry—your means will warrant it; if not, go as many steps toward the best as you can, and, by a gradual improvement you will in time reach the desired goal.' Too much credit cannot be given him, for his thirty years work with Shorthorns in Wisconsin. No one man exerted such a lasting influence toward the improvement of livestock of the state as did this man. He was a conscientious breeder, possessing unimpeachable business integrity, a good neighbor, and a man who had the interests of his community, his State and his country foremost in his heart."[64]

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[62] *Ibid*, Vol. 9, 1879, and Vol. 8, 1878.
[63] W.M.H. Vol. 6, p. 324.
[64] W.M.H., Vol. 6, p. 324.

Introduction of Holstein Cattle by Septer Wintermute.

Registered Holstein cattle were brought to Wisconsin in 1873. The first animal, Elswout Prince 95, H.H.B., came from Mr. H. C. Hoffman, of Horseheads, New York, and entered the herd of Mr. Septer Wintermute, of Whitewater, Wisconsin. This bull was used to grade up a herd that was primarily Shorthorn. Mr. Wintermute bought a second bull, Cruiser 210, before the purchase of any female stock. His herd was typical of a number of early Holstein purchases. They were to grade up "native" cattle, and cattle improved by Shorthorn crosses. It was believed by many that the future profit of dairying would lie in the direction of producing the largest yield from a given number of cows, and that the question of breed as well as feed had very much to do with the matter.

In 1883, ten years after the start of Mr. Wintermute's "experiment" in breeding Holsteins, the results were entirely satisfactory to him. In addition to a larger production of milk there was a steadily growing demand for all the stock he had to sell. Among the important sales were those to the Home Fine Stock Co., Hampton, Iowa, Ira Miller, New London, Wis., C. N. Noel, Stillwater, Minnesota, E. W. Babcock, Cedar Rapids, Iowa, C. L. Converse, Ontario, Canada, M. McAlister, Missouri, and to parties in Indiana and Dakota, in lots varying from 2 to 20 head. Numerous sales were made to parties nearer home, and orders received for more stock than could be spared.[65]

Dairying as a Business, 1880.

A statement that indicates the trend of the time, 1880, as dairying became more of a business, is as follows: "Every detail in dairying must henceforth be managed with the utmost care and skill of which the farmer and manufacturer is capable. The industry has been elevated to a position which it can only retain through the exercise of the greatest skill and intelligence . . . the best breed of cows must be employed.[66]

Another statement is the following: "The dairy business, at present, is 'all the go.' To procure a given number of cows; to keep them after the fashion of our fathers; to convert their milk into butter, in the manner of our grandmothers; to dispose

[65] Jefferson County *Union*, Vol. 14, 1883.
[66] *Ibid.* Vol. 52, 1879.

of the manufactured article, as best we may, in exchange for sugar and tea, will, however, not lead to very glorious results. To use a common phrase, that kind of dairy-business is 'played out.' Much brain work is required, many practical experiments must be made before we ascertain what particular breed of cattle is most profitable; how our cows must be kept; which process is the best, to obtain the largest quantity and the best quality of butter. . . ."[67]

At a farmers' meeting at Kenosha it was said that "an interesting feature of the meeting was a fine display of some of the best families of Dairy cattle by several of the progressive farmers of that county. R. S. Houston, the noted Jersey Butter Maker, exhibited a number of thoroughbred and grade Jerseys. Ward C. White, the veteran dairyman was present with several of his fine Ayrshires. E. A. Carpenter exhibited a splendid imported Holstein bull 3 years old, with several of his calves. It was a matter of deep interest to us to note such a spirit of pride and ambition in their calling as farmers".[68]

Although the notices regarding sale and purchase, as well as of experience, with the new breeds, particularly the Ayrshire, Jersey and Holstein became numerous, the native cow was not put out of the picture at once. The Jefferson County *Union* quoted the fine production of 4,920 pounds each for a herd of native cattle, in an article entitled "Better Cows."[69] J. C. Merriman, Jefferson County, reported a cow of native breed which produced 208 pounds of butter from the 10th of May till the 1st of December, besides giving all the milk and cream used in the family, and having no extra feed until October 1st.

Opinions Regarding the Dairy Breeds.

Many articles written at this time indicate uncertainty and differences of opinion regarding the dairy breeds.

A criticism of the Jersey is the following: . . . "but it is astonishing how much more milk a Jersey cow will give if she only has "grand whole colors"—and the Jersey breeders are ruining the milk record of their cattle. Instead of breeding toward the udder, they are breeding toward some pet notion, and proof of this is to be seen in nearly all the fancy herds. Most of

[67] *Ibid.* Vol. 10, 1879.
[68] *Ibid.* Vol. 11, 1880.
[69] *Ibid.* Vol. 11, 1880.

their stock are mere trash, but they excell in color. One good, forty-dollar, native cow can discount their high-toned colored squabs a year in advance."[70]

Another opinion: "We want Holsteins and Ayrshires for the general milk and cheese supply; we want Short Horns and Herefords for their beef; but the country wants the Jersey for her butter—so let us have an end to the opposition which this breed has met with for forty years. He who specialized wins. The "general purpose cow" is an impossible animal. Let each farmer decide whether all circumstances point to a beef, a milk or a butter breed, and choose his stock accordingly . . . the two tendencies flesh and milk cannot travel the same road together and produce the highest excellence and profit in both."[71]

The following seems to be an extreme case: "Not long since a farmer who keeps a herd of 40 cows, and furnishes milk to a cheese factory, informed us that he was about to buy a Hereford bull. We very naturally inquired if he was going out of the dairy business. He replied "O! no; but I though I would like to increase the size of my cows, as they would make more beef when they get through giving milk."[72]

Mr. R. S. Houston of Ranney, one of the best known of Wisconsin dairymen writes: "Starting with the common cows of the country, I turned my attention to the butter capacity of my herd. After investigating quite thoroughly, I concluded to try the Jerseys, and from that time I have been improving; although for years I manfully withstood the jeers and scoffs of my entire neighborhood, it was only by determined will I persevered. I commenced by raising heifer calves, and when I felt that I was well stocked, occasionally would induce some one to buy a heifer calf, but the most that I could obtain for my early productions was $5. When the stock grew to maturity, I found much better sales and far better prices. For my own use I always bought the very best sire I could purchase, and they must certainly not only be pure bred but registered. When the Guernseys were introduced in the west in 1881, I purchased a Guernsey sire. At first the Guernsey was used rather sparingly, always increasing his service until the present time (1889), and now I shall dis-

[70] *Ibid.* Vol. 11, 1880, and Vol. 14, 1883.
[71] *Ibid.*
[72] *Ibid.* Vol. 14, 1883.

pose of my Jersey at canning prices unless some one applies early that wants a well bred fellow at a give-away figure. I am a thorough convert to the Guernsey cows, and why? They are more docile, larger in frame, have more muscle and bone, more the looks of a farmer's cow, have better sized teats, color their product better, their calves are larger, and taking all in all they are more desirable as a dairy or family cow,—the cow which always finds a ready sale at remunerative prices."

Mr. Houston bred the cow Houston, that lead the herd at the Minn. Experiment Station. She was by a Guernsey bull, and her dam was a full blood Jersey. Houston was nine years old in 1892, and her record at the Station the next year was as follows: Weight, 880 pounds; days in milk 320; pounds milk 6976.1; pounds fat 366.98; average per cent fat in milk 5.3 per cent; cost of food per pound of fat, 10.8 cents.[73]

The Guernsey Breed in Wisconsin.

The Guernsey breed was first brought to Wisconsin, to the herd of N. K. Fairbank, Lake Geneva, in 1881. Later in the year I. J. Clapp, Kenosha, imported a few animals of this breed. By 1884, considerable publicity began to be given the Guernsey cow in Wisconsin. Attention was called to I. J. Clapp's imported Guernsey cattle, now luxuriating in the green fields of Kenosha county, and being greatly admired by the fanciers of that neighborhood. Mr. Clapp had been crossing these cattle on grade Jerseys with good success. The crossed animals were said to have been a much finer looking animal than the Jersey. A successful cross of these cattle on grade shorthorn cattle is also reported and equally good results secured. It was reported that the reason for breeding these Guernsey bulls to high-grade Shorthorns rather than to common cows, of which there were a few very good ones in the dairy herd, was that the breeder wished the dams of the grade Guernseys to be good looking beasts.[74]

Summary.

In summary of the history of the dairy interest in Wisconsin, it is pointed out that the counties of Jefferson, Sheboygan, Fond du Lac, Waukesha, Brown, Dodge, Walworth, Green, and Ken-

[73] Guernsey Breeders Journal, Vol. 2, 1911, p. 73.
[74] Jefferson County *Union*. Vol. 15, 1884.

osha were the pioneer dairy counties of the State. The business had assumed considerable importance in Columbia, Richland, Calumet, Iowa, and Manitowoc counties, with a few cheese factories, creameries, or private dairies, scattered about in other outlying counties.

Discussion.

Starting in 1860 with 521,860 head, the cattle population of the state increased more than threefold, to 1,647,947 head, in 1890. Of this population 39 per cent were classed as dairy cattle in 1860, and in 1890 42 per cent were classed as dairy cattle. These numerical changes fail to show the most significant differences in the cattle population of these two periods. In 1860 as compared to 1890, improved animals were limited to the herds of a relatively few progressive individuals. The cattle were still, for the most part, unimproved native stock. The only improved breeds having a secure footing in the state were the Shorthorns and Devons. By 1890 the Devons, which had been used extensively as working oxen, had become of minor importance. They were shown at the State Fair for the last time in 1892. The influence of the Shorthorn cattle had steadily increased, meanwhile changing from the hands of large speculator breeding establishments, to those of small breeders and farmers after the late '70's. While the Shorthorns were the most popular beef animals, the rapidly increasing dairy business had proved to be too strong a competitor for the beef cattle business.

The success of the Ayrshire, Holstein, Guernsey, and to a less extent the Jersey was in most instances due to the preparatory work of the Shorthorn in grading up the native cattle of the state. The Jersey breed had developed in compact herds. In contrast the Ayrshires in the herds of W. B. Kingsbury and H. S. Durand, Racine, and W. C. White and Chester Hazen, Kenosha, had been extensively used for grading up purposes, as well as for the breeding of registered animals. The Holsteins were used for grading in many pioneer herds. This trend is shown in the registry of fifteen males as compared to three females in the first four volumes of the herd book. Guernsey cattle were frequently used for crossing on both Shorthorn and Jersey foundation animals.

By 1890 all of the dairy breeds, with the exception of the Brown Swiss, which had just been introduced, had many well

established herds, from which animals were regularly being registered.

Early Registered Dairy Cattle and their Importance to Later Generations.

Following the establishment of registered Jersey cattle in Wisconsin, there followed successively the Ayrshires in 1868, Holsteins in 1873, Guernseys in 1881, and Brown Swiss about 1890. A study of the dairy cattle registered in 1890 was made to find whether these breeds were being developed from the original stock brought into the state, from stock from other parts of America, or from stock directly from Europe. The sampling method reported in 1925 by Wright and McPhee, for calculating inbreeding coefficients and relationship coefficients from random ancestral lines of livestock pedigrees, was used as a basis for this study. From each breed two ancestral lines were traced back on each animal in the sample. The samples were taken from the registrations of the one year 1890, except for the Ayrshire sample, this being secured from a five year period due to the small number of registrations. A grouping of the ancestry was made by ten year intervals. A summary of the results is presented in table III. In constructing the table the expected number of animals in each ten year period was calculated with the generation lengths found in this study. The generation lengths are shown in table II. These were slightly but consistently longer than those usually given for the breeds.

The ancestry of the Jersey cattle registered in 1890 were largely found in the V. Fuller and R. H. Stephens herds of Canada, the Darling and Hoe herds in New York, and about 1850, in the Mills herd in Connecticut. Midwestern herds did not have a prominent part at any time. Some of the American Jerseys, however, were found in the ancestry for many years.

The Ayrshire cattle trace largely to the J. Stewart herd of Illinois, the J. F. Converse herd of New York and the J. Dunlop and J. Taylor herds of Scotland. Duke of Ayr 3617, bred in the Taylor herd and his son Duke of Ayr 3rd. 4364, in the Chester Hazen herd in Wisconsin, were both in more than twenty per cent of the random lines.

The Holstein-Friesian cattle trace in many instances to the large importing herds of W. H. Green and W. A. Pratt, in Illinois, to the T. H. Wales herd of Iowa and to Smiths and Powell

in New York. The foundation herd of importance in Wisconsin is that of H. and J. Rust, North Greenfield. The names of Netherland Prince 716, and Netherland Carl 3279, occur in 7.5 and 5.7 per cent of the lines, respectively. Both of these animals were bred in the herd of Smiths and Powell, New York.

A high percentage of the Guernsey ancestry traces to New York and Pennsylvania, and in a few instances to the herd of B. C. Biddle, one of the first Guernsey herds established in America. As with the Holstein-Friesian cattle, Canadian ani-

Table II. Compansion of Generation Lenths Calculated from the Ancestry of Dairy Cattle Registered in Wisconsin, 1890, and Generation Lengths Calculated from Recent Herd Books.[75]

Breed	Wisconsin to 1890		Breed in General
	Number of Generations	Length in Years	Length in Years
Guernsey	737	4.05	3.98
Holstein	762	4.32	3.94
Jersey	1165	4.55	4.20
Ayrshire	1377	4.79	4.44

Table III. Distribution of the Ancestry of 1890 Wisconsin Registered Dairy Cattle by ten year periods

Breed and Location	1850-1860		1860-1870		1870-1880		1880-1890		1890	
Jersey	No.	%	No.	%	No.	%	No.	%	No.	%
Wisconsin	0	0	0	0	1	1	23	21	50	100
Middle West	0	0	0	0	3	3	26	23	0	0
Eastern U. S.	9	8	36	33	58	52	24	22	0	0
Canada	0	0	0	0	15	13	18	16	0	0
Isle of Jersey	110	92	74	67	33	30	19	18	0	0
Ayrshire										
Wisconsin	0	0	0	0	7	4	78	42	88	100
Middle West	0	0	1	1	9	5	17	9	0	0
Eastern U. S.	2	1	14	7	48	26	29	16	0	0
Canada	0	0	2	1	16	9	0	0	0	0
Scotland	182	99	167	91	104	56	60	33	0	0
Holstein										
Wisconsin	0	0	0	0	0	0	20	12	70	100
Middle West	0	0	0	0	7	4	36	22	0	0
Eastern U. S.	0	0	2	1	7	4	31	19	0	0
Canada	0	0	0	0	0	0	0	0	0	0
Friesland and North Holland	162	100	160	99	148	91	75	46	0	0
Guernsey										
Wisconsin	0	0	0	0	0	0	20	12	60	100
Middle West	0	0	0	0	0	0	0	0	0	0
Eastern U. S.	4	3	8	5	14	9	72	48	0	0
Canada	0	0	0	0	0	0	0	0	0	0
Isle of Guernsey	148	97	140	95	134	91	53	36	0	0

mals were not of importance to the cattle of 1890. Buckskin 834, bred by Silas Betts, New Jersey, received 13.6 per cent of the ancestral lines. The animals of early Wisconsin breeders were in this instance more prominent, with Barney 1568, bred by I. J. Clapp, Kenosha, and Nutwood 1408, bred by N. K. Fairbanks, Lake Geneva, each having 9 per cent of the ancestral lines.

Importation, both from America and abroad, was playing a more important role in the building up of the registered dairy herds of 1890 than was the breeding from foundation animals in the early Wisconsin herds.

Conclusion

The general cattle population of Wisconsin in 1890 consisted of a native foundation graded up by Shorthorn, and during the latter two decades of the period, more and more by dairy breeds. Forty-two per cent of the population was classed as dairy stock. Of this group three-tenths of one per cent were in registered herds.

Summary

The genetic history of the cattle of Wisconsin involves four prominent phases over the period to 1890:

1. That of the cattle of French importation; cattle predominately from Normandy and Brittany. These were of importance to the time of the Black Hawk war, 1832.
2. That of the native cattle, descendants of the cattle of the American colonies. These became of major importance after 1832, and were the cattle of the territorial days, 1836-1848.
3. That of the improved breeds; first the Shorthorn and Devon, and later, particularly, the dairy breeds. These have been of importance since the early days of the State. Within the registered dairy herds the original animals brought into the State were exerting only a minor influence in 1890.
4. That of the improved native and grade cattle; these forming the general cattle population of the State in 1890. In

[75] Iowa Bulletin 290.

the development of this group the Devon and Shorthorn were used through 1850-1870. After this date the Shorthorn and representatives of the dairy breeds were used for general improvement.

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GEOGRAPHY OF THE NORTHWEST DAIRY REGION OF WISCONSIN

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MAJOR LINEAMENTS

In the Northwest Dairy Region of Wisconsin, (Fig. 1.) cultural features reflecting the high degree of specialization of dairying are imposed upon an undulating glacial topography. Here climatic conditions (Koppen Dfb) have left their imprint upon both natural and cultural forms. Conspicuous features in the rural landscape are the large red dairy barns with silos nearby, alternating plots of woodland pasture and cultivated fields of feed crops, and the numerous herds of high grade or pure bred dairy cattle. At irregular intervals along the well-kept gravel roads which assume, in general, a rectangular pattern are small urban centers. In each town and village is a multiform, small scale industrial development which is intimately associated with dairying. Numerous relict forms suggest the evolution of a succession of past cultural landscapes.[1] Thus in its broader aspects the Region[2] is characterized by those forms, patterns, and associations which are typical of the North Central Dairy Region of the United States, of which it is a part.[3] More intensive study, however, reveals elements of unity in both the natural and cultural features of the Northwest Dairy Region of Wisconsin which are not found in the adjoining areas.

RURAL LANDSCAPE

In driving along the well-kept gravel roads which form a well defined grid, plots of wooded and improved land are passed in rapid succession. Woodlots occupy 30 to 40 per cent of the farm land[4] and the distant hills usually appear as densely

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[1] A discussion of the past landscapes has been omitted due to lack of space. In the original dissertation, of which this paper is a summary, one chapter was devoted to the evolution of forms and patterns. Much other valuable material likewise had to be deleted.

[2] The term Region will be used when referring to the entire Northwest Dairy Region.

[3] Smith, J. Russell, North America, 1924, pp. 330-339.

[4] All quantitative data, unless otherwise specified, have been obtained from the Wisconsin Crop and Livestock Reporting Service and the United States Census, 1930.

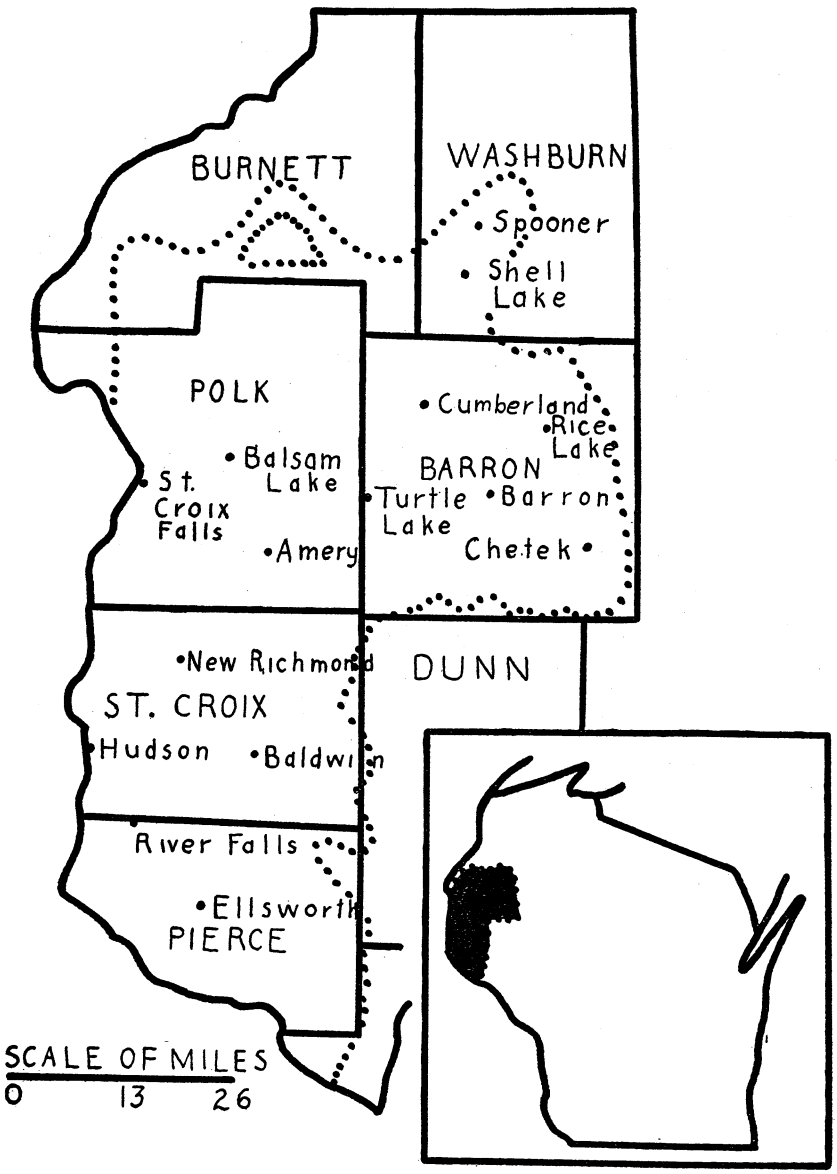

FIG. 1. Index Map of Northwest Dairy Region.

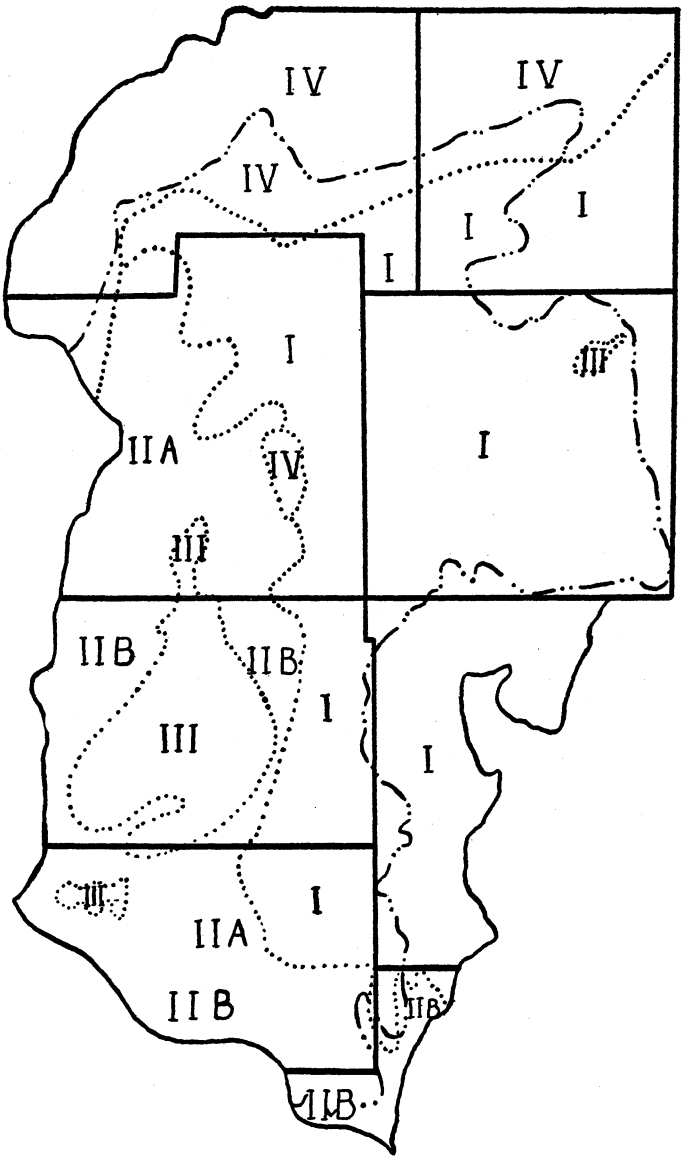

FIG. 2.

Original Natural Vegetation. I. Mixed Pine and Oak Forest. II. Hardwood Forest A. Maple Group, B. Oak and Oak Openings. III. Brush Prairies. IV. Pine and Scrub Oak. (Reference: Chamberlin, T. C., Atlas of the Geological Survey of Wisconsin, 1870, Plate II A.)

wooded tracts. The distribution of woodland is not uniform but is definitely related to surface conditions and the distribution of the original vegetation. (Fig. 2.) Although no well defined pattern of woodland may be distinguished, the northeast-southwest trending moraines in the northwestern part and the few deeply

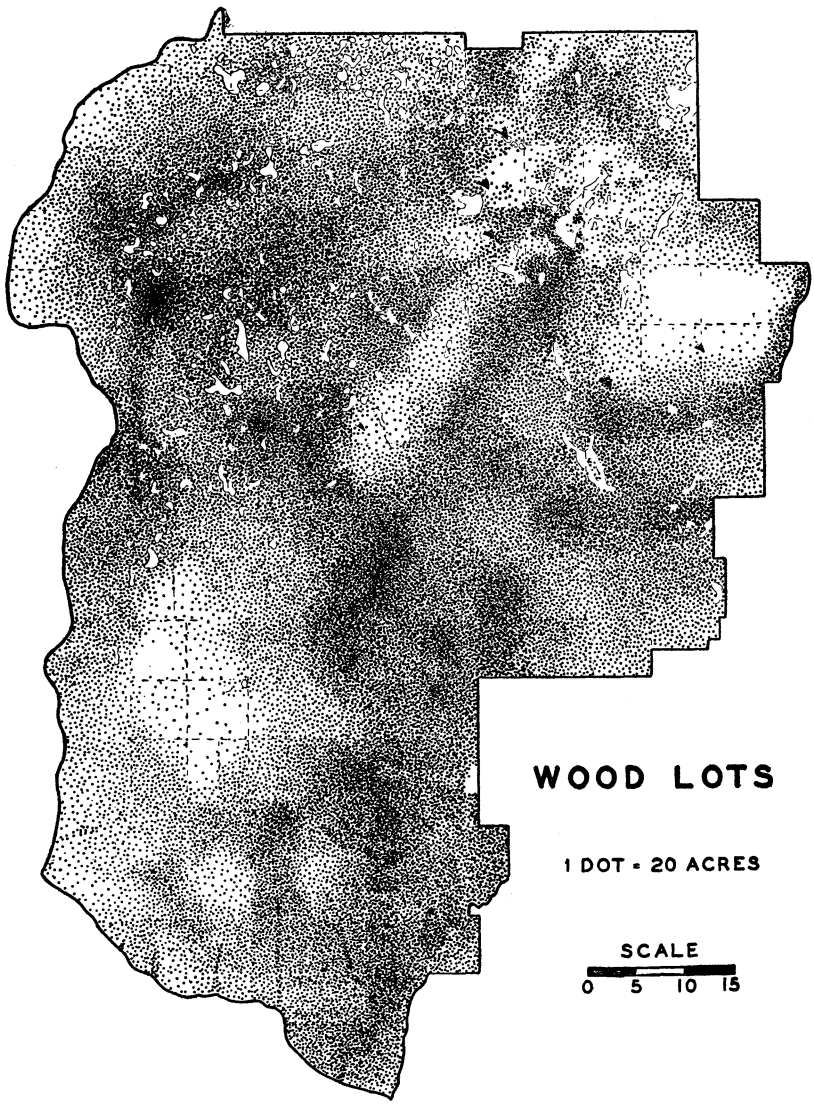

FIG. 3. The total area of woodland included in farms, by minor civil divisions. This does not show woodlands not included in farms.

incised valleys in the southern part of the Region are areas of greatest concentration. (Fig. 3.)

Most of the woodlots are enclosed by barbed wire fences so that they may be used as grazing land for the numerous herds of dairy cattle. Forty-four per cent of the land in farms is de-

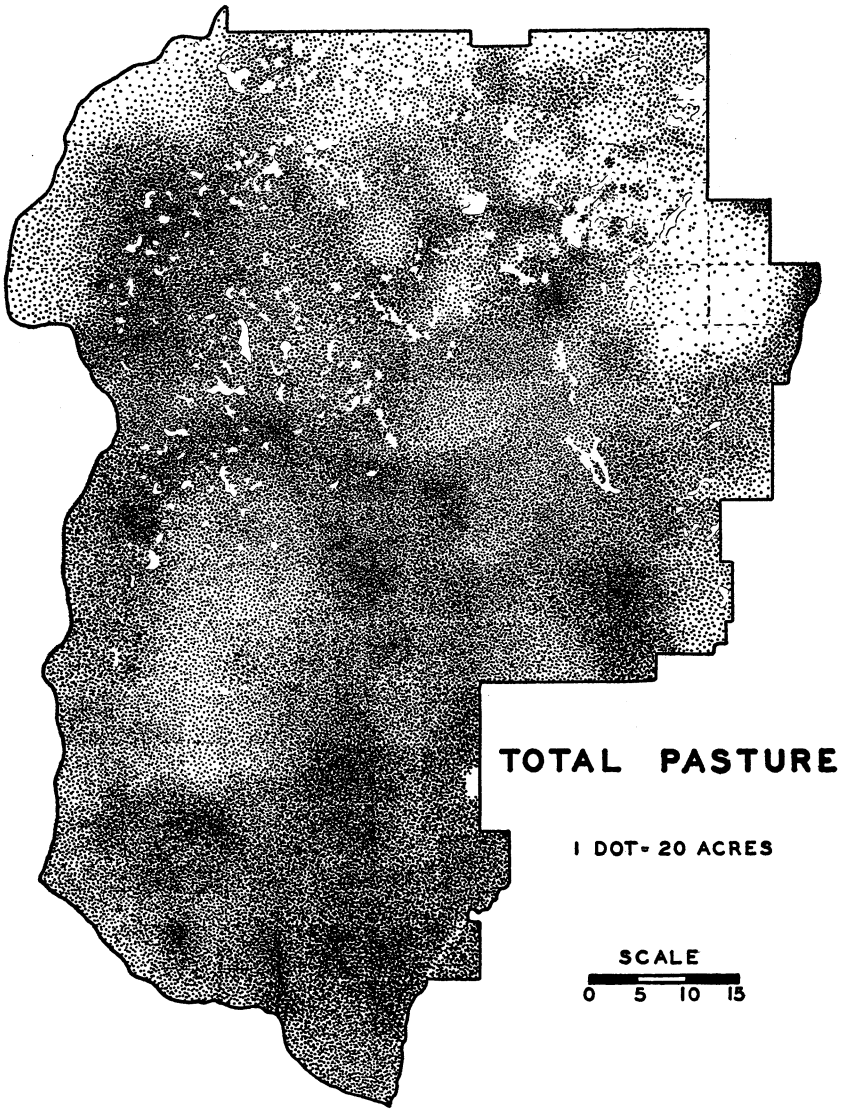

FIG. 4

voted to pasture of which two thirds is woodland. (Fig. 4.) Poorly drained areas, lake borders, steep slopes, and stony land provide other types of permanent grazing land while rotational pasture accounts for the remainder. In these pastures may be seen large herds of Holstein and Guernsey cattle, the two breeds which predominate. (Fig. 5.) The herds vary in size from fif-

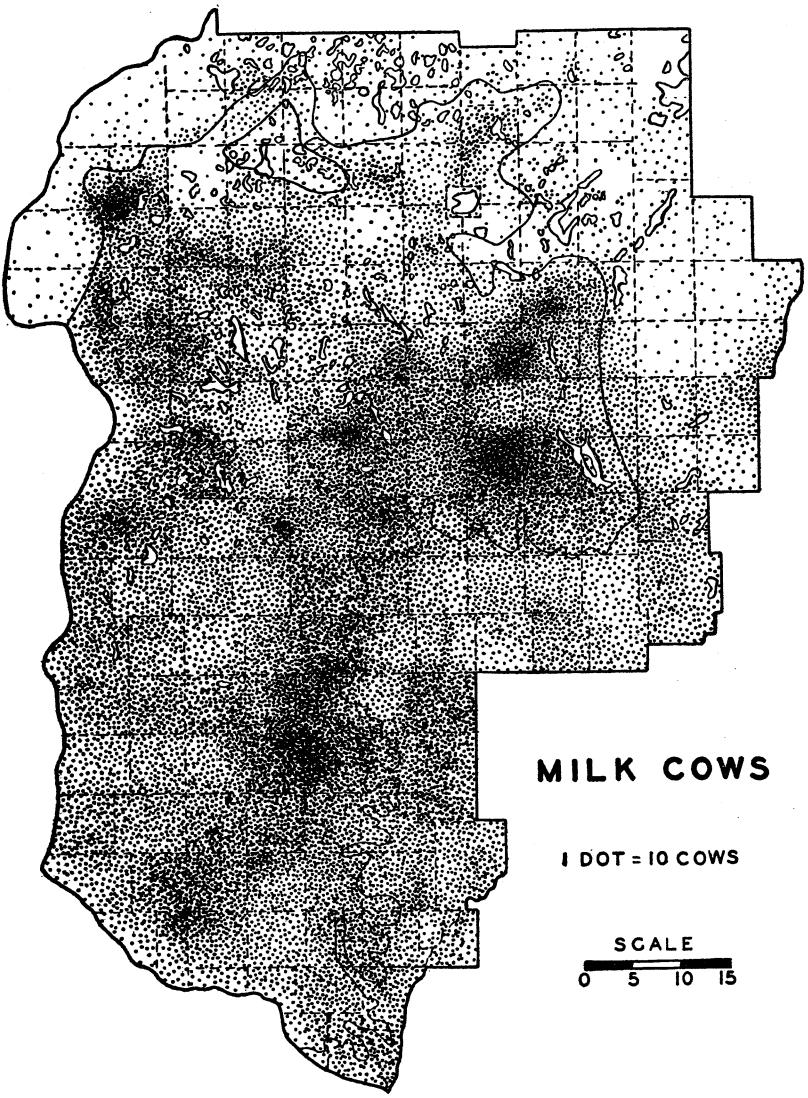

FIG. 5

teen to twenty head each, of which milk cows account for about two thirds.

Improved land accounts for the major part of the non-wooded areas. An average of 52 per cent of the land in farms is devoted either to crops or plowable pasture. Like the woodland the percentage of land improved is closely related to the original vegetation.[5] Crops occupy 46 per cent of the farm land, a percentage which is rather uniform throughout the Region since the production of feed is an important adjunct to dairying. Hay, oats, corn, and barley, four important feed crops, in the aggregate occupy 93 per cent of the cropped land. The remaining 7 per cent is chiefly devoted to a variety of cash crops, such as peas, cabbage, and potatoes. (Table I.) Not only are these

Table 1*

Land Use in the Northwest Dairy Region—Data by Civil Towns

I.	Percentage of total area devoted to specific uses.	
	1. Land in farms	81 per cent.
	2. Crop land	38 per cent.
	3. Pasture land	36 per cent.
II.	Percentage of farm land devoted to specific uses.	
	1. Crop land	46 per cent.
	2. Pasture land—all kinds	44 per cent.
	Plowable	6 per cent.
	Woodland	29 per cent.
	Other pasture	9 per cent.
	3. All other uses	10 per cent.
III.	Percentage of total crop land devoted to specific crops.	
	1. Hay—all kinds	33 per cent.
	Clover and Timothy	30 per cent.
	Alfalfa	3 per cent.
	2. Oats	30 per cent.
	3. Corn	18 per cent.
	4. Barley	12 per cent.
	5. All other crops	7 per cent.

crops of major importance in supplying rations for the cattle during the long and cold winters but also are they important in supplementing pastures during the latter part of the summer

[5] In the originally forested areas plowable pasture accounts for only 4 or 5 per cent of the farm land while in the area of original prairies it accounts for 10 to 15 per cent.

* Compiled from the files of the Wisconsin Crop and Livestock Reporting Service.

when droughts are commonly experienced. The quality of much of the woodland pasture is poor and therefore it is often necessary to supplement it with feed even during the summer months. Crops do not occupy any particular sites other than well drained land since a regular system of rotation is practiced and fields devoted to corn one year will likely be planted with small grain the next and with hay the following year.

During the growing season which lasts from May until September the Region is the site of great activity. Early in May the ground is prepared and the crops are planted. Scarcely has the planting of corn been completed before some fields are ready to be cultivated. By mid-June the hay harvest has started. During this season with its long duration of sunlight per day women are frequently seen helping in the fields. Hay tools are extensively used, especially the tall hay loader, thus reducing to a minimum the number of laborers needed.

Hay is the most important of the crops, occupying one third of the cultivated land. Clover and timothy have the largest acreage although in the past few years the acreage of alfalfa has rapidly increased. With alfalfa two or three crops of hay may be cut per year, making it possible for half an acre to provide a cow with feed for approximately six months of stable feeding.[6] The repeated cutting of this hay tends to control the spread of noxious weeds, since less opportunity is given for the production of seed. This is of major importance in the control of Canada thistle which has become a serious menace to the farmers. Furthermore alfalfa is more drought resistant than clover and timothy making it less hazardous to raise. Occasional summer droughts, however, affect even alfalfa in such a way as to reduce the yield or even hinder the starting of a new crop. Under these conditions "emergency hays" must be raised. Wild hay is of minor importance throughout the Region although small quantities are harvested from the marshes in a few places. The distribution of hay acreage is rather uniform for the Region.[7] (Fig. 6.)

While the hay harvest is in progress, the fields of oats and barley are taking on an amber color which indicates that the

[6] Fraser, Wilbur, Productive Crop Rotation Boosts Profits, Hoard's Dairyman, January 22, 1926, p. 39.

[7] In the north central part of the Region where there is a low percentage of the land in farms the total hay acreage is small but the ratio between farm land and hay acreage remains almost constant.

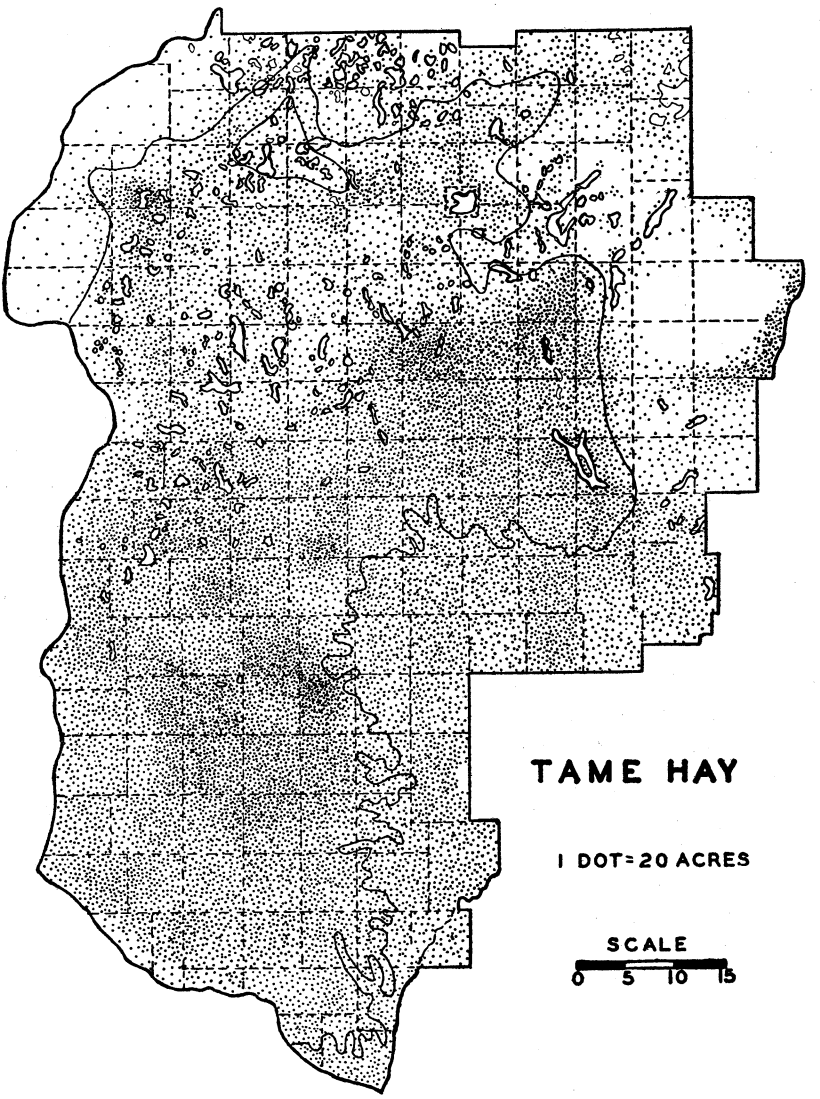

FIG. 6

grain harvest must soon follow. By the middle of July, long rows of shocks have replaced the continuous mass of waving grain. Threshing and storage of grain follow in rapid succession, and over the broad terrain many small threshing outfits with the associated features that accompany the harvest may be seen. Little time is lost in the harvest due to rain since 60 per

cent of the 30 inches of annual precipitation comes in the form of conventional showers which provide the maximum amount of precipitation in a relatively short time. Oats and barley, the two most important small grains, fit well into the scheme of dairy farming. Not only do they provide an important source of stock feed but also supply a large amount of bedding for the animals. The long period during which the cattle must be kept in the stables makes this an important item in the farm management. The sufficiency of rain in the early part of the summer and the long, clear days which provide about 15 hours of sunlight per day during the ripening and harvest seasons are very favorable for these two crops. Oats utilize 30 per cent of the crop land while barley occupies an additional 12 per cent. Often these two grains are intercultured, the mixed grain being used for cattle feed. Although small acreages of wheat and rye are found, they are of minor importance in the crop association.

No sooner has the threshing been completed and the grain stored than fall plowing is begun. This practice is generally followed, since plowed ground can better absorb the melting snow in the spring, and at the same time it provides an effective way of combating quack grass. By the latter part of August the landscape presents a vastly different aspect from that which was observed a few weeks earlier. Plowed fields, exposing the brown soil, occupy a prominent place in the rural landscape.

By the first part of September silos are being filled and the corn harvested. Corn occupies 18 per cent of the cultivated land and is produced both for silage and grain. Over two thirds of this acreage, however, is utilized for silage and in Barron County 84 per cent of the acreage is so used. Only in the southern part of the Region is any considerable amount grown for grain and even here less than half the acreage is devoted to this purpose. The brevity and variability in the duration of the growing season and the cool summer nights combine to make corn production for grain a precarious enterprise. Furthermore, silage is of major importance in the rations for dairy cattle and provides succulent feed during the winter when most of the other feeds are dry. This has been of considerable importance in the maintenance of a steady production of milk throughout the winter. The importance of corn for silage is reflected in the numerous silos found within the Region.

With the coming of winter activities are much less pronounced. Since the Alberta Storm Track is nearby, cyclones are well developed during this season and weather conditions are quite variable. These storms are accompanied by cloudy skies and moderate to heavy snowfall, the average snowfall amounting to a total of 46 inches.[8] The low altitude of the sun, the short duration of daylight, and the high percentage of cloudiness prevent the sun from effectively melting the snow, permitting a snow cover to remain for four months. One of the greatest handicaps to the delivery of milk during the winter is the blocking of highways by the mammoth drifts of snow. Although a great mileage of snow fence is used, special equipment must be employed to keep the roads open, thus adding a burden to the cost of road maintenance. During this season cattle are kept in the barns and their absence in the pastures is noticeable.

The structure of the large, red barns reflects the importance of this long period of stable feeding. The roofs are invariably of the gambrel or half-hoop type which provide a maximum mow space for the storage of hay. Adjoining most of the barns is a large, white concrete or red wooden silo. Barns characteristically occupy sites on the side of a hill so as to provide adequate drainage and at the same time facilitate the construction of a building of the half-basement type.

Nearby and half hidden among the clump of poplar and elder trees is the large, two-story, frame, farm house, surrounded by a well-kept, shady lawn. Flowers brighten many of the lawns in the summer; especially are driveways and garden fences lined with rows of hollyhocks. Large flocks of white chickens run at will about the farmstead. Towering above the tree tops is the vane and wheel of the metal windmill. Upon closer observation numerous utensils associated with dairying may be seen set in the sun near the house.

Farm Economy

Dairying is by far the most important element in the farm economy. The sale of milk and cream accounts for 55 per cent of the gross farm income and much of the remaining 45 per cent is derived from the sale of intimately related products such as

[8] United States Department of Agriculture, Weather Bureau, Climatological Data of the United States by Sections, Section 47, Revised 1930.

cows and calves, poultry, and hogs. Since the Region lies within the great creamery belt of the Upper Mississippi Valley where butter production is the chief type of dairy enterprise, approximately three-fourths of the milk produced is used by creameries. (Fig. 7.) Cheese factories receive 17 per cent of the total milk produced and only 3 per cent is sold as fluid milk on the city

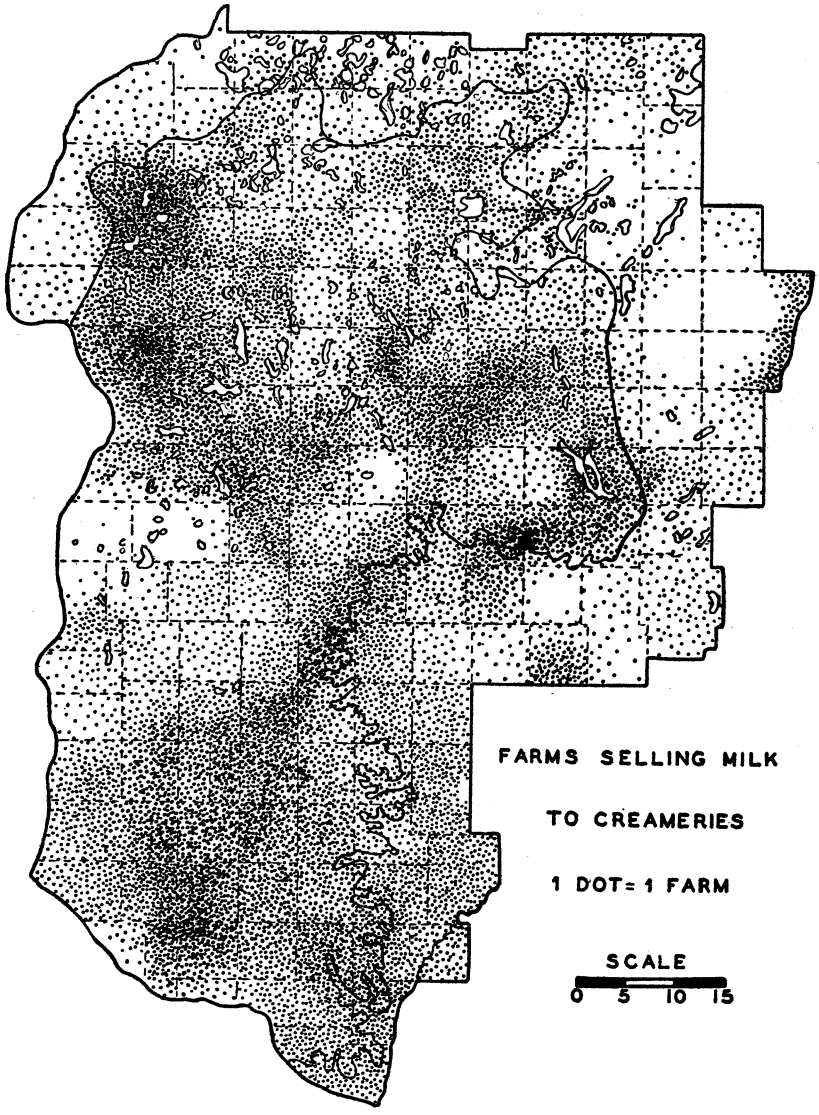

FIG. 7

market. The fifty-nine creameries of the Region make more than twenty-three million pounds of butter annually, much of which is sold on the Chicago and New York markets. Over 75 per cent of these creameries are coöperatives, owned and operated by the farmers. The great number of Danes and Scandinavians who brought with them from Europe the heritage of coöperation are, in part at least, responsible for the extensive development of coöperation.[9]

Refrigeration is of prime importance in butter production especially where the butter is made from sweet cream. In this land of numerous lakes and long, cold winters natural ice is plentiful and cheap and it has been an important factor in the development of butter production. Many of the creameries, however, are now being equipped with electrical refrigerators which provide an easier, more sanitary, and more reliable source of ice. Drying plants are being added to the equipment of creameries so that in addition to butter, dried butter-milk and dried skimmilk are also important creamery products. Many uses are being found for these dried products, one of the most extensive being for poultry feed. The creameries are all located in the towns and villages and appear as a part of the urban landscape.

Although only 17 per cent of the milk produced is used for the manufacture of cheese, this production is mostly concentrated in three centers and therefore has become relatively important locally. (Fig. 8.) The area of greatest concentration is northwestern St. Croix County and southwestern Polk County. Here the milk is used almost exclusively in American cheese production. The second center forms a crescent around the northern part of Barron County. Swiss and brick cheese production is becoming increasingly important in this area. The production of foreign cheese is intimately associated with the Swiss element in the population which has come into the Region from Green County, Wisconsin, the most important center of foreign cheese manufacture in the United States. The third center of production is along the eastern edge of the Lower Magnesian Cuesta in St. Croix and Pierce counties. In both of the last two cheese areas, butter production is intermingled with the cheese industry and there is not the marked concentration that

[9] The creamery at Luck, a Danish settlement, boasts of being the first coöperative creamery in Wisconsin.

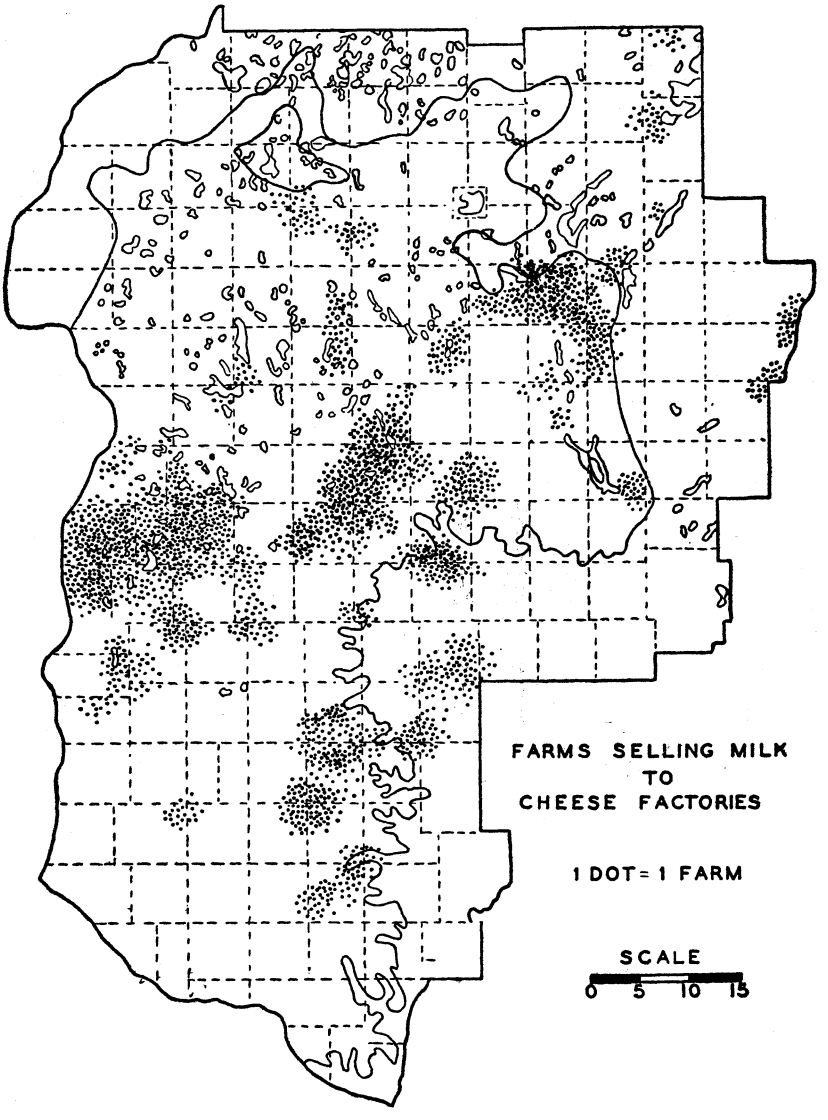

FIG. 8

is found in northwestern St. Croix County. The production of cheese finds expression in the landscape through the long, low cheese factories with their characteristic tall smoke stacks, whey tanks, and long ricks of fuel wood. Cheese factories usually occupy sites at cross roads and serve an area of about four square

miles. Thus cheese factories are a part of the rural landscape. In the urban centers cheese box factories and storage houses also reflect the importance of cheese production.

The amount of milk sold for the city market is strikingly low, especially when it is realized that Minneapolis and St. Paul with a combined population of almost three quarters of a million are within twenty miles of the Region. The explanation of this anomalous condition lies in the history of the organization and operation of the Twin City Milk Producers Association which has effectively controlled the milk market in the Twin Cities for the past fifteen years.[10]

The sale of cows and calves, a source of income intimately related to dairying, provides 12 per cent of the farm income. Especially is the sale of high grade dairy cattle for herd replacement purposes important. The well organized breeders associations which carry on effective advertising campaigns, the constant attempts to improve the herds through testing associations, and the fact that all the cattle within the Region have been tested for tuberculosis, have made the Northwest Dairy Region an attractive place for cattle buyers to come to from all over the United States and even foreign countries. In addition, a great number of calves are sold to the stock yards at South St. Paul each year. Although stock pens are usually found at the railroad stations most of the calves are trucked to the South St. Paul market.

The sale of poultry and eggs provides an additional 12 per cent of the gross farm income. Over half a million dollars is derived annually from the sale of eggs alone. White leghorns are the most important breed of chickens although other breeds are found. Many factors favor the raising of poultry. Dried milk is plentiful and cheap and serves not only as an important food but also as a tonic. Grasshoppers and bugs are numerous and make up an important part of the rations during the summer. Wild animals, however, are a constant menace to the poultry producers. There is a wide distribution of poultry and every farm has at least a small flock of chickens. There are, however, a few centers of concentration such as around the village of

[10] In order to sell milk through this association each farmer is required to buy one share of stock for each five cows milked. Since the stock carries double liability the association is not permitted to sell its stock in Wisconsin and thus Wisconsin farmers are eliminated from even prospective membership.

Baldwin and in the northwestern part of the Region. Around Baldwin the intensity of production is closely associated with a settlement of Dutch while in the center of concentration there is a large Danish element in the population.

Although about ten per cent of the farm income is derived from the sale of hogs, the number found on any one farm is usually small. Where whey is recovered from the cheese factories or, in the southern part of the Region where corn can be safely grown for grain, the density of the hog population increases. The Northwest Dairy Region, however, is definitely not an important hog producing region. All the remaining livestock and livestock products account for no more than 1 per cent of the farm income.

Cash crops supply the remaining 10 per cent of the farm income. Peas for canning provide an important crop of this type. The crop is produced near the eleven towns where canning factories are located.[11] The greatest pea acreage is found on the relatively level strips of outwash where the soil is friable and has uniform texture. The importance of the crop, however, is reflected more by the viners scattered through the producing section and in the large canning factories in the villages nearby than in the area actually occupied by the crop itself. Although there are only slightly more than ten thousand acres produced in the entire Region, and each producing farm usually raises less than five acres, nevertheless this crop is of considerable importance in the farm economy in the northern half of the Region. Other cash crops of importance locally are potatoes, rutabagas, cabbage, and grain for seed. These crops, like peas, give but minor expressions in the landscape.

Regional Subdivisions

Although cultural features associated with dairying are imposed upon a glacial topography throughout the entire Region, the difference in the intensity of development and the change in natural conditions due to the recency of glacial invasion readily suggest two maior subdivisions—(1) The New Drift Dairy Province and (II) The Old Drift Dairy Province. (Fig. 9.)

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[11] Canning factories are located at Frederic, Milltown, Rice Lake, Barron, Clear Lake, Amery, New Richmond, Chetek, Cumberland, Turtle Lake, and Centuria.

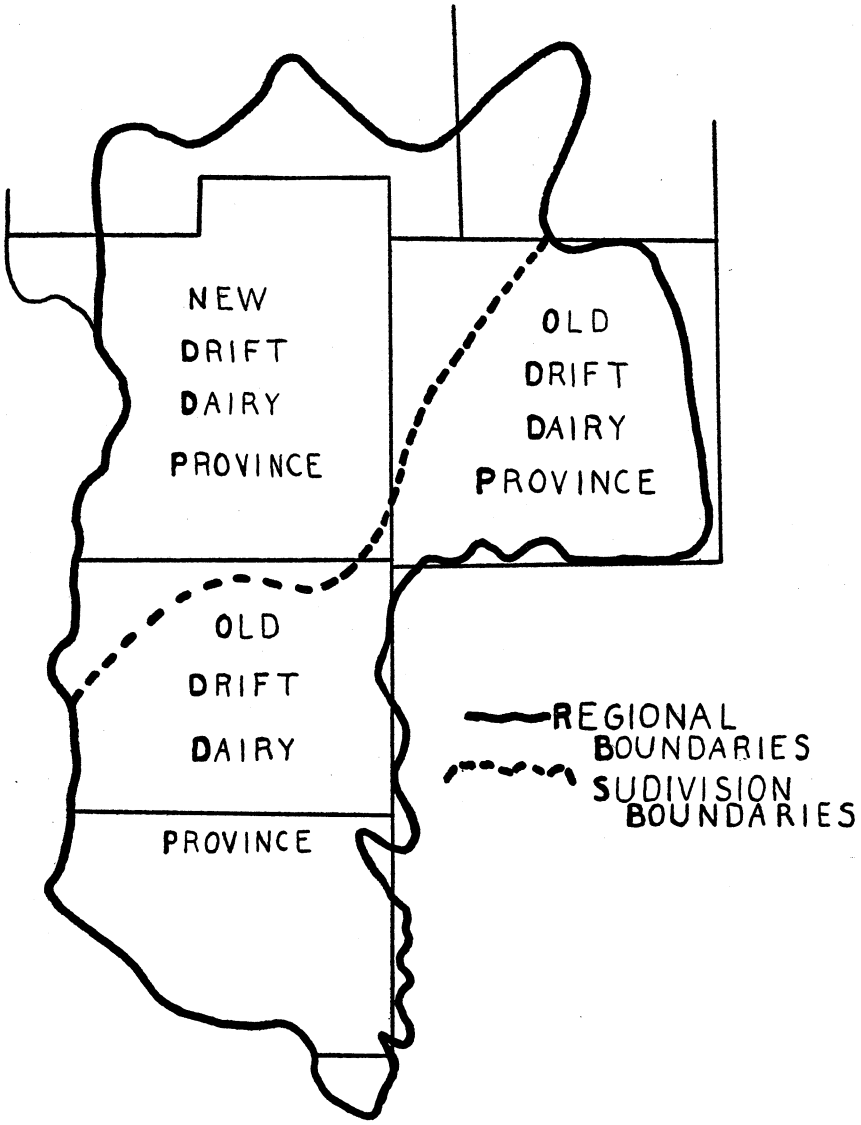

FIG. 9. Regional Subdivisions.

I. THE NEW DRIFT DAIRY PROVINCE

In the northwest part of the Region is a broad belt of complex glacial topography which embraces five roughly parallel, northeast-southwest trending morainic ridges and intervening areas of pitted outwash and rugged ground moraine. Here

is found a variety of soils varying from light sandy loams to heavy silt loams, which are infested with numerous granitic and trap boulders. Lakes and swamps are numerous; lakes account for approximately 5 per cent of the total area of the province. Covering this complex topography, except where it has been removed by man, is a natural vegetation which consists of second growth hardwoods and a few scattered conifers with the ubiquitous sweet fern forming an abundant undergrowth. This uninviting part of the Region was the last to succumb to the invasion of the farmer with the resultant sparse population and low percentage of improved land. Here only 72 per cent of the total area is in farms and in some parts of the province only half of the total area is so used, in contrast with 81 per cent for the Regions as a whole.

Feed crops, characteristic of the Region as a whole, and cleared pasture vie with woodland for sites on the billowy terrain. Here where the topography is rough, the rectangular pattern of fields and roads is less prevalent. Even within this subdivision there is a gradual transition from more intensive use in the southern part where 60 per cent of the land is improved, to the northern section where only 20 per cent of the area is so classified. In the southern part American cheese production is of prime importance while in the north butter production replaces cheese. The recency of glaciation is reflected in the deranged drainage systems and the numerous water-falls which have resulted from the superimposing of streams over trap ridges and rock ledges. The entire province is within the drainage basin of the St. Croix River, the three most important tributaries being Willow, Apple, and Clam rivers. Hydro-electric power plants, successors to the flour mills of an early stage of occupance, are found at the sites of water-falls along these rivers. The largest power plant is located at St. Croix Falls where the St. Croix River has cut a narrow, post-glacial channel through one of the trap ridges and produced the Dalles of the St. Croix. In the northern part of this brush-covered and lake-dotted area, sportsmen find a favorable haunt and the resort industry competes with dairying in importance especially during the summer months.

II. The Old Drift Dairy Province

In the south and east part of the Region gentle undulations replace the rugged moraines, the soil is less stony, and poorly drained areas occupy much less space than in the province to the northwest. Lakes, while not entirely absent, are minor features in the landscape and landforms resulting from the erosion of bed rock are much more conspicuous than depositional forms. The mantle of glacial material has softened the former erosional surface so that the present topography consists of low, gentle swells separated by broad, poorly drained swales. All the major streams head in these broad swales and flow through poorly defined post-glacial channels. Only near the edge of the Lower Magnesian Cuesta do a few streams occupy narrow, steep sided, deep, pre-glacial channels.

From the crest of one of the gentle swells a wide view meets the eye of an observer. Large rectangular fields of hay or grain give to the landscape the appearance of a broad, undulating checker board. The clumps of trees, which often mark the sites of farmsteads, break the continuity of the cleared fields and relieve the monotony which characterizes the true prairies of the West. Occasionally a patch of darker green may be seen in the broad, open valleys, which markes, the sites of a marsh, so characteristic in the original landscape. Many of the marshes have been drained by means of drainage wells.

Farm land in this province accounts for 90 per cent of the total area as compared with 72 per cent in the New Drift Dairy Province. The amount of woodland varies greatly from place to place and reflects the original vegetation cover. In western Pierce and St. Croix counties on the gentle back slope of the Lower Magnesian Cuesta the original vegetation was a brush prairie. Here woodlots account for less than 10 per cent of the farm land while in the northern part of the province (Barron County), which was a part of the great boreal forest, many of the farms are one-third wooded. But even this is less woodland than is found in the adjacent part of the New Drift.

Throughout the province plowable pasture becomes an important element in the rotation system. Since pastures of this type are of higher quality than woodland, a small amount is needed for each herd and the total acreage in pasture here is

relatively low. In many places in the province not more than one-fourth of the farmland is devoted to grazing.

In Pierce and St. Croix counties, where the present system of farming has evolved from a cash grain type, dual purpose cattle are more frequently found than in the northern part.[12] Likewise the sale of milk and cream accounts for only 50 per cent of the farm income and the sale of hogs provides an additional 14 per cent for this southern section as compared with 62 per cent and 3 per cent, respectively, in Barron County. Another contrast is in the cash crops since grain for seed provides an important cash crop in the south, and potatoes and peas are important in the northeast. These differences, however, produce but minor contrasts in the landscape and therefore do not serve as the basis for a major division.

URBAN LANDSCAPE

Forms and patterns associated with dairying and the production of cash crops find expression not only in the rural landscape but also in the towns and villages scattered throughout the Region. The location of each town is marked by a tall, metal water tank which rises above the tree tops and bears its name. Although there are many small villages which break the continuity of the rural landscape, large cities are absent. Rice Lake, with a population of 5,177, is the largest city in the entire Region and has almost twice the population of any of the other urban centers. Only 18 per cent of the people of the Region live in the ten cities which have a population of over one thousand[13] while 69 per cent live on individual farms or in villages of less than one hundred. This is in striking contrast to the state as a whole, for only 30 per cent of the people of Wisconsin actually live on farms and 70 per cent live in agglomerations.

The absence of large cities in the Region is due, in part at least, to the proximity of the Twin Cities which dominate the commercial interests. Minneapolis and St. Paul wholesale houses

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[12] Dual purpose cattle account for 12 per cent of the cattle in Pierce and St. Croix counties while in Barron County they account for only 1.2 per cent.

[13] The ten cities having a population of over one thousand are:

Rice Lake	5,177	Barron	1,863
Hudson	2,725	Cumberland	1,532
Spooner	2,426	Amery	1,354
River Falls	2,363	Ellsworth	1,124
New Richmond	2,112	Chetek	1,076

supply most of the stores with their stock of goods. The mills of Minneapolis furnish much of the flour and feed shipped into the Region and newspapers from the Twin Cities are more commonly found at newsstands than are Wisconsin papers. The few roadside signs advertise Minneapolis and St. Paul stores and most of the people living in the Region visit the Twin Cities at least once or twice a year on shopping tours. Both highway and railroad systems favor this domination since the major lines of communication focus upon these cities from all parts of the Region.

On the basis of function, four types of urban centers have been recognized. They are (1) the small villages which serve as market centers for the surrounding rural areas, (2) the seats of county government which not only have forms and patterns associated with market villages but also have added features which reflect their governmental function, (3) the towns and cities which serve the resorts associated with the numerous lakes in the northern part of the Region, and (4) the three cities which are as important industrially as they are commercially.

Market villages, the most common and wide-spread type, are simple in structure and, as the name indicates, are essentially marketing centers for the farm products and distributing points for staples needed by the farmers in their umlands. There is a wide range in size, varying from small hamlets with approximately fifty or seventy-five people to towns of eight or nine hundred. Villages of five to six hundred are the most common, however. Although railroad sites are the most popular, nineteen of the sixty-five market villages are not located on a railroad.

Most of these "inland" villages are small, the population rarely exceeding one hundred. The hamlets occupy sites at cross roads; only rarely are other streets found in the plat. In any one of these villages two or three general stores occupying sites on the corners, a small coöperative creamery, a filling station, and a few houses resembling closely spaced farmsteads, are the usual forms. The creamery usually occupies a small building surmounted by one or more galvanized ventilators and a tall smoke stack. In the lot adjacent are long ricks of fuel wood. Nearby is found an ice storage house in which blocks of natural ice are stored for summer use. The butter is shipped by truck to the nearest railroad village and sent from there to eastern

markets. In a very few of these villages, located on power sites, small feed mills are found in the village set-up.

Railroad market villages, while very simple in structure and function, have additional forms and patterns which reflect the advantages offered by the better means of transportation. All the market villages have the usual array of general stores, a milk processing plant, and services which reflect the agricultural development in the adjoining areas. Occasionally there is evidence of industrial aspects in some of the villages. In the northern half of the Region where large areas of outwash are present, pea-canning factories provide striking features in the village landscape. In the southern part of the Region, where wheat was formerly the all important crop in the system of farming, canning factories are not found. In these villages, however, tall grain elevators characteristically located along the railroad tracks are very conspicuous features. Every railroad market village here has one or more of these elevators, many of which are no longer used but stand as relict forms of an earlier period of occupance.

In the five *political cities* of the Region there is an even wider range in size than was found in the market villages.[14] These cities have many aspects similar to the market villages but have additional forms and patterns associated with the handling of the county governmental business. The county court house in most places occupies a central position in the city and about it is clustered the business district. Near the court house are found a large number of offices of lawyers, abstract and loan companies, insurance companies, and the headquarters for the different breeders' associations. These cities are well supplied with cafes and hotels to care for the visitors who must come to the county seat to transact business. The residential sections of these cities are usually more attractive and better cared for than in the market villages, since here are found the homes of many professional people. In each of the five political cities, industrial development is of minor importance and is usually associated with dairying.

In the northern part of the Region, where there are numerous lakes, extensive swamps, and much wild country, one of the major functions of the towns and cities is to serve the people

[14] Hudson—2,725; Barron—1,863; Ellsworth—1,124; Shell Lake—826; Balsam Lake—315.

who are seeking recreation. These *resort towns* occupy sites along the railroads, so that provisions and recreational supplies may be easily obtained, and they are also given direct contact with the larger cities of the Middles West, from which most of their patrons come. Within these cities there are forms which are unique to this type. In the business district of the resort towns, the large number of food stores and merchandising establishments dealing in resort equipment are out of proportion to the local population. Out-of-state automobile licenses are numerous during the summer months and the cities appear to be thriving commercial centers. The resort business is highly seasonal and the permanent population must depend upon small industries, most of which serve the surrounding agricultural area, to supplement the commercial function of the town and provide a steady source of income. A milk processing plant and some type of woodworking establishment provide the two most common industrial forms. The industrial aspect of the towns and cities, however, is not striking. The most important towns of this group are Spooner, Cumberland, Amery, St. Croix Falls, and Chetek. Even the small market villages nearby experience a pulsation of increased business during the vacation period.

In New Richmond, River Falls, and Rice Lake *industrial and commercial* aspects are about equally important. The industries, many of which have persisted from a former period of occupance, provide an important element in the urban landscape. The three cities are strikingly similar in structure and site characteristics. Each is roughly bisected by a river which provides an important source of power in the industrial development. Adjacent to the streams are the industrial sections of the cities. These rivers tend to disrupt the otherwise uniform rectangular pattern of streets. Since New Richmond and River Falls are in the part of the Region where wheat production was formerly dominant, feed and flour milling industries are the most prominent features in the industrial set-up. In Rice Lake, situated in the area of original forests, woodworking industries predominate. Both woodworking and flour milling industries, however, are prominent in all three cities. Rice Lake is the oldest of this group, having evolved from an Indian village, a fur trading post, a lumber camp and sawmill center to the present industrial-commercial city.

STATE GEOLOGICAL SURVEYS OF WISCONSIN

E. F. BEAN

The thirty year period prior to the establishment of the first geological survey of Wisconsin was characterized by great interest in geology in United States. During that period twenty-two state geological surveys were organized, of which sixteen were organized prior to 1840. By that time geology had found a place in the curricula of the leading colleges. The young state of Wisconsin had an especially good reason for following the precedent established by the older states, as the lead of the southwestern part of the State had drawn the first large body of settlers to Wisconsin. *The Madison Argus* under date of Oct. 10, 1848 urges the value of such an organization.

"*Importance of a geological survey of Wisconsin.* After the state government is fully organized, and the state gets free from debt, a wise and beneficent policy will doubtless dictate to our rulers the necessity and propriety of a thorough geological exploration of its surface. Few are aware of the benefits derived from such surveys, not only to individuals, but as developing hidden resources in the aggregation of immeasurable value to a commonwealth. Wherever they have been authorized, (as they have been in most of the eastern states), the attendant cost has been but an insignificant trifle compared with the valuable discoveries made. But very little is known of Wisconsin. Beyond determining the general outlines of its principal strata, if we except the lead region, nothing has been done. It is not a year since granite was discovered in Dodge County, and we are informed that the iron mines of Horricon have been known but few years. From Lake Michigan to the Mississippi—an interior country of over two hundred miles in width, by five hundred in length—a great blank exists so far as accurate and clearly defined knowledge is concerned. It is true we possess some isolated facts. We know that iron exists in large quantities along the banks of the Wisconsin near its mouth—we know that boulders of copper and iron, and traces of lead are often met with—but whence they came, to what extent they exist in the parent bed—and of what value, we are entirely ignorant. The search for

useful metals on the shores of Lake Superior has extended southward but few miles. But few facts have reached us of discoveries made within the state, and yet the specimens found leave but little doubt that large mineral deposits will be found in the interior of that section. These evidences thicken daily as settlements increase, and to determine the mineral regions and fix their boundaries—to examine valuable quarries—to prevent that waste of labor often bestowed blindly in search of what does not exist—is the province of the geologist—and such an investigation would not be less valuable to our citizens, than to science in general. As soon as the finances of the state will warrant, we doubt not that this important investigation will be demanded by the general voice of our public spirited and thriving people."

Just how little was known regarding the natural resources of the state is reflected in the sentence from the *Argus* of June 25, 1850.

"Had our state line been run from Green Bay to St. Paul, it would have embraced about all the valuable farming country, and the balance might have been given to Minnesota with thanks for the taking."

I. Edward Daniels. 1853-1854.

Under an act of the Legislature approved March 25, 1853, a State Geological Survey was created, with an annual appropriation of $2500 per year for four years. Edward Daniels was appointed State Geologist by Governor Leonard J. Farwell. Mr. Daniels appointed H. A. Tenney, Assistant, by and with the consent of the Governor.

Daniels was a "political apothecary"[1], a "Professor in the College at Waukesha", "Lecturer on Kansas Affairs"[2], "who has taken an active part in politics as he has a right to do"[3].

On June 30, 1854 Mr. Daniels was "peremptorily" removed by Governor Wm. A. Barstow. The majority of an investigating committee of the legislature in 1855 reported that the Governor had no power to remove the State Geologist, that it is impossible for Daniels to "be professionally incompetent for the duties of

[1] Clarke, John M., James Hall. Geologist and Paleontologist, p. 287.
[2] Milwaukee News.
[3] Madison State Journal, Oct. 3, 1859.

the office to which he was appointed, and the removal is unjust to his character and reputation as a man of science, and to his pecuniary interests, in view of the arrangements which he had made with the expectation of being allowed to prosecute his work unmolested".

The First Annual Report of the Geological Survey of Wisconsin was a small octavo volume of 84 pages published in 1854. This dealt largely with the lead region. This was in accordance with the statutory provision which required "that it shall be the duty of said state geologist to complete his survey of that portion of the state known as the 'lead mines' before commencing the survey of the remainder of the state". The following is quoted from a review of this report in the Beloit College monthly.

> "For its indications of the great benefits that will result from the continued prosecution of the survey, this report is even more valuable than for the facts it contains. If that is carried on in the manner in which it has been commenced, it will undoubtedly result in 'causing those exhaustless mines of wealth' that lie beneath the surface of all over the state 'to contribute to our common growth and prosperity' in a manner altogether unexpected. Considered merely in its pecuniary results, the appropriation by which this Survey is sustained was probably one of the most profitable investments that has been made for a long time by our rather spendthrift Legislature."

2. J. G. Percival. 1854-1856.

J. G. Percival was appointed in August, 1854, by Governor Wm. A. Barstow, and served until his death on May 2, 1856. He graduated at Yale College in 1815, after which he studied medicine. He wrote poems, edited a newspaper, was proofreader and assistant to Noah Webster in the preparation of his dictionary. In 1824 he was for a short time Professor of Chemistry at West Point. From 1835 to 1841 he had charge of geology for the Connecticut Geological and Mineralogical Survey.

"Percival was a singular and extraordinary figure in American literature and science, a ragged Ishmaelite whose soul was ever bursting into song, a hapless genius who knew no friendly voices except those of the woods and the rocks, who bubbled out his real soul in rime and wrote the most atrocious and barren of all geological documents. 'His clothes were shabby; his trousers more often than otherwise frayed at the bottom and patched

in various places by his own hands. Eight months of the year he wore an old glazed cap with ear-tabs of sheepskin, the wooly side turned in, and a gray cloak. Whenever the cap came off it revealed a classic head and for the first time one would notice the fineness of the features and eyes of unusual splendor. * * * He became a familiar figure in the fields and woods of Wisconsin and was generally known as Old Stonebreaker. Some of the boys made sport of him but little children all over the state knew and loved him. He was always poorly clad and suffered greatly from exposure in winter.' * * * *."[1]

Two reports in the form of octavo pamphlets of about 100 pages each were issued as a result of his work. The first of these was published under his own supervision; the second after his death. There were two editions, one in English, and one in German. As with his previous work in Connecticut, these reports are extremely prosy and made up largely of very minute descriptions of the lithological nature of the various rock formations of the state, their geographic distribution and relative position.

3. Hall, Daniels, and Carr. 1857-1862.

A law approved March 3, 1857 provided for a geological and agricultural survey of the state under the joint supervision of a commission consisting of James Hall, Ezra Carr, and Edward Daniels. It appears that Mr. Carr was the prime instigator in the passage of this bill, though working more or less in collaboration with Charles Whittlesey and Edward Daniels. In a letter from Carr to Hall, in anticipation of the passage of this bill, under date of January 28, 1857, the directorship of the survey is offered the latter, who, in a reply dated February 3, following, said that he could not apply for the same so long as Daniels was a candidate, as he had already agreed to give him his support. Under date of March 26 Carr again wrote Hall:

> "The governor and all others who are interested in the survey look to you as the responsible man in geology. The Governor understands Daniels and said to me that you and myself, being a majority, could arrange matters."

James Hall was state geologist of New York from 1836-1898 and at this time was state geologist of Iowa, and had an impor-

[1] Clarke, John M.; Hall, James. Geologist and Paleontologist, p. 287.

tant engagement with the Survey of Canada. He was an excellent geologist, splendidly equipped by training and experience to undertake the work. He was to "work out the general geology, the relations of the geology of this state with that of surrounding states, and the paleontology of the state, and properly to represent the same upon a map, or maps, sections, etc., and make the collections illustrative of the same".

Ezra Slocum Carr was a doctor of medicine, who became professor of chemistry and natural history at the University of Wisconsin in January, 1856. He had been an assistant to Hall on the New York Survey. His task was to make the agricultural portion of the survey "to make collections for the same, together with the requisite analyses of soils, ores, and useful minerals, put up and arrange the entire collections contemplated by said act, and do such work in the general and economical geology as time will permit". His only geological publication was Economic Geology of the Third District of New York. New York Geological Survey. Annual Report: 385-388 (1840). It appears that he did but little field work in Wisconsin.

Since Hall spent but little time in the state, Carr was probably the executive officer. The published record indicates that he made no particular contribution to the survey. During the war he gave the required course in chemistry at Rush Medical College. In the autumn of 1868 he resigned from the University and went to California, where he became professor of medical chemistry in Tolland Medical College, and of agricultural chemistry in the University of California. In 1877 he was elected state superintendent of public instruction. After four years he retired to Pasadena, where he died in 1894.

Edward Daniels' duties were to "work out the general, local, and economical geology of the state; to collect such specimens of fossils and useful minerals as will illustrate the geology of the state, and deposit them in the place specified in said act".

The act appropriated $6,000 per annum for six years, "which sum shall be in full for salaries of commissioners, rent of room, and all other expenses incident to said survey, exclusive of printing the annual report of said commissioners".

This joint leadership proved unsatisfactory and the Governor reported in January, 1858 "that the commissioners have not arranged and distributed the functions of the survey and that Daniels is the only one who has signed a contract". Daniels,

according to an assembly committee report dated March 19, 1858, "has, in less than six months, drawn out of the treasury, under warrant of the late Executive, $2017.81, and from his report and other indications, it appears that he has his single-handed commission in full operation now, with an honest effort and hearty good will to spend the balance of the appropriation". The report referred to is one addressed to Governor Bashford entitled "Annual Report of the Geological Survey of the State of Wisconsin, for the year ending December 31, 1857". This is an independent report in which he makes no mention of the other commissioners except the phrase "since assuming the duties of my department of the Survey". A large part of the 62 pages is devoted to the iron ores of Dodge and Jackson counties. On May 29, 1858, Governor Randall entered into a contract with each of the three commissioners. Under this contract which was to continue until March 3, 1863, each commissioner was to receive $2000 per year for his salary, and that of assistants, and all other expenses exclusive of printing. In 1858 Hall and Carr employed, at their expense, Charles Whittlesey to explore the country between the Menominee and Oconto rivers. In the spring of 1859 an engagement was entered into with J. D. Whitney to make a survey of the lead region.

In 1860 James Hall was appointed principal to the commission. The work of both Whittlesey and Whitney was completed and an act passed and approved April 15, 1861, authorizing the publication of one thousand copies of what was expected to form the first volume of the report, for which Hall was to receive $3.00 per copy. The single volume of 455 pages, 9 plates, a colored geological map of the lead region, and a diagram showing the position of the ore crevices, appeared in 1862, entitled "Volume I, Geology of Wisconsin". Chapter I, Physical Geography and Geology, and Chapter IX, Paleontology of Wisconsin, were written by Hall. Chapters II to VI inclusive, descriptive of the lead and zinc region, were written by Whitney. It appears that two reports by Whittlesey, one on the region west of the Menominee River and the other on the iron region of Lake Superior mentioned in the preface, were not published at this time. In 1863 Whittlesey presented a paper before the Boston Society of Natural History entitled "The Penokee Mineral Range". This paper was published in Geology of Wisconsin, Vol. III, pp. 216-223, (1880). An incident, unintentionally amusing to those con-

versant with the careless manner in which Whittlesey prepared his manuscripts, is given. In explanation of certain typographic errors he wrote: "In Chippeway language the name of iron is *Pewabik;* and I thought it proper to designate the mountains where this metal exists in quantities * * * * as the Pewabic Range. The compositor, however, transformed the word into *Penokie,* a word which belongs to no language."

In 1862 the Committee on State Affairs reported that $30,000 had been expended without any return whatever except the one volume report. The Committee thought that sum "ample to have secured the services of three capable men, but managed and controlled as it has been by the present commissioners, it has proved a failure in every respect except in expenses incurred". This statement is not entirely accurate. In addition to Daniels' Annual Report, the following had been published:

Report of the Commissioners of the Geological Survey of Wisconsin. Madison. 1858.

Report of Progress for 1859.

Report of the Superintendent of the Geological Survey, exhibiting the progress of the work. Jan. 1, 1861. This includes 42 pages of fossil descriptions.

The second volume of Hall's report, it is stated, was prepared and submitted to the Governor in December, 1862. It appears to have never been published.

The legislature in 1862 repealed the act authorizing the survey. Carr and Daniels abandoned the field, but Hall, contending that he had a contract under seal with the Governor according to provisions of the law, claimed that the legislature could not annul the same. He continued his labor and completed that portion of the work which had been assigned to him in his original division among the three commissioners. It is stated that manuscript for a second volume of the report had in 1875 been ready for publication more than a dozen years, and Hall had made repeated applications to the legislature for compensation, but in vain. Under the circumstances, Hall was obliged to publish his paleontological results elsewhere[1].

[1] Hall, James. Preliminary Notice of the Fauna of the Potsdam Sandstone, with remarks upon the Previously Known Species of Fossils and Descriptions of Some New Ones, from the Sand stone of the Upper Mississippi Valley, Transactions Albany Institute, Vol. 5, 1867, pp. 93-195; 16th Annual Report, New York State Cabinet of Natural History, 1863, pp. 119-206.

Geological Survey of the State of Wisconsin, 1859-1863, Paleontology, Part Third, Organic Remains of the Niagara Group and Associated Limestones, Albany, 1871, 94 pp.

That the importance of a geological survey was not entirely forgotten during the ensuing years is indicated by the following quotation from the annual message of Governor Lucius Fairchild in 1869:

> "A thorough geological survey of this state is much needed. Could we present to the world a scientific and comprehensive account of our vast mineral and agricultural resources, it would draw hither, within a few years, millions of dollars of capital for investment. In such an investigation of her hidden sources of wealth, Wisconsin is far behind the neighboring states of the Northwest. If it is not deemed best to provide for such a survey without further information, I respectfully suggest that a competent committee be appointed to investigate, and fully report to the next legislature, upon the necessities of the state in this direction. Such investigation and report can probably be had at little or no expense."

4. JOHN MURRISH.

Commissioner of the Survey of the Lead District.

There was enacted in 1870 an "act to provide for the survey of the lead district, making maps and collecting statistics and specimens from the same". John Murrish was appointed commissioner. He was a practical man who had served an apprenticeship in the mines of Cornwall. His report, a pamphlet of 65 pages, was submitted with Governor Fairchild's message in 1871. In 1872 the commissioner was given authority to extend the survey to "include all mineral deposits of an economic value found in the vicinity of said line of survey, or of the several iron or copper ranges in the north part of this state".

5. LAPHAM-CHAMBERLIN SURVEY. 1873-1879.

The legislature in 1873 provided for "a complete geological survey" with an appropriation of $13,000 for each year until the completion of said survey". This sum was to cover all expendi-

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This appears to be a reprint of the report written in 1864 and entitled Account of Some New or Little Known Species of Fossils from Rocks of the Age of the Niagara Group, 20th Annual Report, New York State Cabinet of Natural History, 1867, pp. 305-401.

Geological Survey of Wisconsin, James Hall Director, Geological Map of Wisconsin showing the Relations of its Geology with that of the Surrounding States, compiled from the work of the Geological Surveys of Wisconsin and Iowa and from the Surveys of Doctors D. D. Owen, Foster, and Whitney, and Professor A. Winchell. (Date of Publication not determined.)

tures except printing of reports. The law directed that the survey be completed within four years.

In 1877 provision was made for the continuance of the survey for one year. The legislature in 1878 made an appropriation of $5,000 to continue the work until March 31, 1879. All salaries were to cease on that date "but this act shall not bar the members of the geological corps from voluntarily performing the functions of their office, and supervising the publication of said reports".

LAPHAM. 1873-1874.

Increase A. Lapham was appointed state geologist April 10, 1873, an excellent choice, since he had long been a leading spirit of science in the state. As early as 1849 his recommendation for a quarry site as "the most eligible location" for a penitentiary was quoted in Governor Dewey's message. He had published two geological maps of the state—one in 1855 and another in 1869. As counselor and friend he had been very helpful to Hall and Carr. Hall agreed in 1853 to prepare a work called "American Paleontology", to be based upon manuscript furnished by Lapham. Nothing seemed to come of this but through no fault of Lapham. "By profession a civil engineer, he became at an early day a faithful collector, observer, and recorder of natural phenomena in nearly all leading lines from bed rock to sky. He was at once a botanist, a zoologist, an archeologist, a geologist, and a meteorologist. He was a distinguished example of the best order of the old school of all-round students of natural science. Probably we owe to Dr. Lapham, more than to any other single individual, the establishment of our Weather Service"[1]. From his arrival in the state in 1835 until his death in 1875, he took an active part in all movements aimed to advance science and education in the state.

Lapham chose as his assistants R. D. Irving, T. C. Chamberlin, and Moses Strong.

Moses Strong was a graduate of Yale, and had one year of graduate work at Sheffield Scientific School, one at Clausthal, and a third at Freyberg[2]. He was drowned August 18, 1877, in the Flambeau River while attempting to save the life of an assis-

[1] T. C. Chamberlin. Science. Vol. 52, p. 5, 1920.

[2] Annual Report of the Wisconsin Geological Survey for the year 1877, p. 91.

tant. His death at the age of 31, closed a career which gave every promise of being a brilliant one. The results of his field work during the field seasons of 1873-1877 are recorded in his reports on the lead region, the Mississippi region north of the Wisconsin, and the upper St. Croix region.

Roland D. Irving was a professor of geology at the University of Wisconsin from 1870 until his death in 1888. A graduate of the School of Mines, Columbia College, and with field experience in Ohio, he was well prepared for his work with the Survey. He reported upon the geology of central Wisconsin, the Penokee iron range, and the Keweenawan. In his Penokee iron range study, he was compelled "to encounter unwarranted expectations raised by previous flattering opinions respecting the richness of the iron deposits given by uncautious and inexpert explorers. His perfectly candid and unreserved report brought the usual reward of frankness and sincerity in the face of opposing desire, at first a storm of protest and of adverse criticism, which even threatened the existence of the survey; later, a sullen acquiescence in the truth, and finally, an admiration for the correctness and the courage of the position taken and a diversion of enterprise from unprofitable into successful lines of exploitation"[1]. In 1880 he began the geological investigation in the Lake Superior region for the United States Geological Survey, which continued until his death. "His loss at the fruitful stage of his work, incalculable as it is, might have been still greater but for the fact that all his material passed into the hands of his co-laborer, Professor Van Hise, who is intimately familiar with his unwritten as well as written views"[2]. T. C. Chamberlin was graduated from Beloit College in 1866. In 1869, after a year of graduate work at the University of Michigan, he was called to the "settee" of natural sciences at the State Normal School at Whitewater. In 1873, he became professor of geology at Beloit. Lapham and Chamberlin were instrumental in securing the passage of the bill authorizing the survey. He was professor of geology at Beloit College during his service with the Survey, was president of the University of Wisconsin from 1887-1892, and head of the Department of Geology, University of Chicago, from 1892-1919.

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[1] President T. C. Chamberlin. American Geologist. Vol. III, p. 3. 1889.
[2] President T. C. Chamberlin. American Geologist. Vol. III, p. 4. 1889.

O. W. WIGHT. 1875.

Dr. Lapham was appointed by the Governor after the adjournment of the legislature, and his name through some oversight was not sent to the senate during the 1874 session of the legislature. In 1875, Gov. Wm. R. Taylor, sent the name of Dr. O. W. Wight to the senate, who, as Wight reports, "confirmed the appointment with singular unanimity". The letter from Irving to Hall in February 1875 reflects the feelings of that scientist[3]. All of the assistants tendered their resignations, but were requested to withdraw their resignations and continue their work, which they did, with the exception that Gustavus Bode replaced W. W. Daniels as chemist.

T. C. CHAMBERLIN. 1876-1882.

T. C. Chamberlin was placed in charge of the Survey in February, 1876 and continued in charge until 1882, although all field work was officially completed in 1879. Wisconsin was fortunate in having a man of his ability to direct the work. He, with his assistants, laid a broad foundation of geological knowledge extremely valuable as a basis upon which to found investigations of more direct and specific scientific and industrial importance. The Lapham-Chamberlin survey was started at a time when a state geological survey was viewed as a project that could be completed in a few years. It was not until later that it came to be realized that a survey is valuable as a continuing service, not only in advancing the frontier of geological knowledge but in serving as adviser to citizens and to municipalities. Chamberlin of course realized that "the survey in the seventies swept over the Pleistocene formations and those that underlie them at the rate of about 4000 square miles a year, and thus perforce had something the nature of a birds-eye view"[1]. In the annual report for 1877, he states "The work will not be, and in view of the extent of the field, its wilderness, and its inherent

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[3] "Our geological survey has gone the fate of its predecessors—or rather a worse one. The governor has appointed a disreputable politician to Dr. Lapham's position, leaving the survey still unorganized. We had accomplished an immense amount of work, having produced as many as one hundred detailed colored geological and topographical maps, the whole lead region having been covered with contour lines at 50 foot verticals according to Whitney's recommendations in your volume. It is probable that none of it will ever see light. One reason of the trouble was my refusal to call the Penokee ores so rich as Col. Whittlesey makes them to be. Wisconsin has most certainly had ill luck with her surveys."

[1] USGS Professional Paper 106, p. 13. 1918.

difficulties, could not be exhaustive, with the facilities at our command".

The results of this survey were published in the four volume Geology of Wisconsin, which is still in constant use as a valuable reference. There has since been much additional study of the geology of the State, but the main outlines have stood with but little modification. Geology of Wisconsin, Vol. II, was published in 1877. A second edition was ordered by the 1878 legislature and placed on sale in November 1878, indicating the popularity of the report. Vol. III was published in 1880. This was accompanied by 14 atlas plates. Vol. IV, published in 1882, was accompanied by 12 atlas plates, and 5 plates of a general nature that were intended to accompany Vol. I which was published in 1883. The last paragraph of the preface to that volume gives us an impression of Chamberlin, the scientist.

> "And now, as with this first which has become last, I lay down, with inexpressible relief, the burden of this work, which has notwithstanding, been largely a labor of love, I have greatly to regret its imperfections, of which no one can be more painfully conscious than myself. Such as it is, it is presented to the magnanimity of a generous people."

While much of the text of the four volumes was written by his assistants, Chamberlin did an amazing amount of work himself. He selected his assistants and directed their work. At the same time he did the field work necessary for his contributions to the reports. His investigations were highly varied. To Vol. I he contributed 300 pages of general geology, as well as chapters on building materials, soils, and artesian wells; for Vol. II he wrote the geology of eastern Wisconsin; for Vol. III he edited the notes of Moses Strong on the Geology of the Upper St. Croix District; for Vol. IV he wrote "Ore Deposits of Southwestern Wisconsin".

The physical task of supervising the publication of these reports was a tremendous one. That he, with the assistance of Lapham, was able to secure funds to the extent of at least $100,000 from the legislature is a reflection of his genius. His tactics in securing appropriations was to approach the chairman of the finance committee and perhaps one or two leaders and outline in a simple, straightforward fashion what was needed, for what it was needed, and why it was needed. His success was due to the

"transparent reasonableness of his requests". He had the knack of convincing the legislature that there was no doubt that the State should carry on the work, that it would be done by competent men, and that the obvious solution was to grant the appropriations.

During the progress of the survey, annual reports were submitted. The reports for 1873-1875 were published in Geology of Wisconsin, Vol. II. The reports for 1876-1879 were each separately published.

Lapham and Chamberlin were able to attract to the Survey a corps of excellently trained men. The assistant state geologists chosen by Dr. Lapham were all well trained and all relatively young men—R. D. Irving, 26; Moses Strong, 27; and T. C. Chamberlin, 30. Other men who contributed to the reports were W. F. Bundy, Gustavus Bode, T. B. Brooks, F. H. Brotherton, I. M. Buell, A. C. Clark, A. D. Conover, W. W. Daniells, J. E. Davies, P. R. Hoy, A. A. Julien, F. H. King, W. J. L. Nicodemus, Raphael Pumpelly, J. D. Salisbury, E. T. Sweet, G. D. Swezey, C. R. Van Hise, R. P. Whitfield, Arthur Wichman, L. C. Wooster, Chas. E. Wright. The report was notable in that the microscopic investigation of rocks by means of thin sections was an important feature.

In the legislative plans for publication in 1876, the wise counsel of Chamberlin is evident. The contents of Vol. I are outlined and provision is made for 7000 copies of that volume and 2500 copies of the complete report to be distributed as follows:

"Each school district within the state shall be entitled to one copy of the volume provided for by section 1 of this act; each high school and incorporated academy to 6; each normal school and incorporated college, to 15; and the State University to 25 copies, respectively, of said volume. Each member of the legislature of 1876 and 1877 and 1878, the governor, lieutenant governor, secretary of state, State treasurer, attorney general, superintendent of schools, and each judge of the supreme court, shall be entitled to two copies of the complete report. Each officer of the present senate and assembly, each incorporated college or academy, each normal school, each high school, each State charitable or penal institution, each person who has rendered assistance in the prosecution of the survey, each scientific society in the State, and each town or city library, established under

the provisions of chapter 80 of the General Laws of 1872 shall be entitled to one complete copy. The State University, the Wisconsin Academy of Sciences, Arts, and Letters, the Historical Society, and the State library, shall each be entitled to 10 complete copies. The remaining copies shall be placed in the hands of the governor and chief geologist for distribution to public libraries, scientific men, learned societies, and colleges beyond the limits of the State, preference being given to those situated in the centers of capital in the United States and in Europe, and in such other ways as may best serve the objects of the survey".

In 1878 the legislature authorized publication of 1500 additional copies of the report and maps to be sold by the superintendent of public property.

6. Geological and Natural History Survey 1897-193_.

At the annual meeting of the Wisconsin Academy of Sciences, Arts, and Letters December 27, 1893, a committee consisting of C. R. Van Hise, C. R. Barnes, E. A. Birge, G. L. Collie, and A. J. Rogers was appointed to secure legislation establishing a geological and natural history survey. In 1894, the Academy voted to recommend to the legislature the bill prepared by the committee. The committee report published in the 1894 proceedings outlines the purposes of the proposed survey under the following titles: occurrence of iron ores, road materials, soils, forests, forage plants, windbreaks, food and enemies of fish, pearls, educational value, topographic maps, school manuals, and economic reports. The vision of the committee is shown by the fact that nearly all of the plans would be considered timely if published today. An appropriation of $15,000 per annum was requested. The bill was recommended for indefinite postponement by the Committee on Claims in the 1895 legislature. The committee with Dr. Van Hise as chairman finally secured the establishment of the Survey by the legislature in 1897, with an appropriation of $5,000 per year.

The Survey was governed by a board consisting of the governor, the state superintendent of public instruction, the president of the state University, the president of the commissioners of fisheries, and the president of the Wisconsin Academy of Sciences, Arts, and Letters. The administration and work of the

Survey during the first biennium has been rather closely followed since that time; hence some consideration will be given to the beginning of the present Survey.

I. There was a close relationship with the University and other educational institutions. The president of the University was regularly president of the commission until 1931, when the Survey was placed in charge of the Regents of the University. Dean E. A. Birge was its director from the beginning until 1919, when, as president of the University, he became one of the commissioners and president of that board. Dr. Van Hise was consulting geologist until he became president of the University and president of the Board in 1903. The offices and laboratories have always been in University buildings. Professor C. Dwight Marsh of Ripon, Professor L. S. Cheney of the University, Professor D. P. Nicholson of Lawrence, Professor G. L. Collie of Beloit, Professor R. D. Salisbury of Chicago were contributing their services to the Survey. E. R. Buckley and S. Weidman were employed as assistant state geologists. Professor L. S. Smith was in charge of hydrography.

2. Scope of Work. At first there were two divisions—Geology and Natural History. In 1909 a third division—Soils—was added.

3. Publications. The bulletins were planned in three series:

(1) Economic.

Bulletin I. On the Forestry Conditions of Northern Wisconsin, by F. Roth.

Bulletin IV. On the Building & Ornamental Stones of Wisconsin, by E. R. Buckley, was in type.

(2) Scientific.

Bulletin II . On the Habits and Instincts of the Solitary Wasps, by Geo. W. and E. G. Peckham.

Bulletin III. On the Pre-Cambrian Igneous Rocks of the Fox River Valley, by S. Weidman, was in type.

(3) Educational. Manuscript had been submitted for bulletin V, The Geography of the Region about Devils Lake and the Dalles

of the Wisconsin, by Professor R. D. Salisbury of Chicago University.

4. Plans for the Future. Dr. Birge urged* as projects of primary importance:

(1) Study of the clays and clay industries.
(2) Investigation of rocks in southern part of the state for road materials.
(3) Study of natural waters.
(4) Topographic mapping.

He adds, however, "All of these subjects are of economic importance or immediately allied to subjects which are economic. To investigations of this sort a major part of the money appropriated by the state for the Survey must always be devoted as it has been in the past; but the Survey would fail to perform its duty to the state if it did not regard a diffusion of the knowledge of nature as one of its main functions. It should be the duty of the Survey to prepare reports on the plants and animals of the state, looked at both from a scientific and popular point of view; to report on the physical geography, geology, and paleontology. In many cases the field work will have to be done almost or wholly without compensation, but the Survey should be ready to aid such studies when of sufficient importance by the payment of expenses, and in similar ways, and should also be ready to publish the results of such investigations when completed. Nor will the Survey complete its duty unless a reasonable proportion of the money granted by the state is devoted to furthering these investigations, which may seem not to have economic value at once, but which experience has shown are sure to become of value, not merely to the intellectual, but to the material progress of the state".

Since the turn of the century the Survey has followed rather closely the policies outlined by Van Hise and Birge. Much attention was devoted to highways and a highway division was organized in 1907. Active work was carried on in this field until 1911, when the Highway Commission was organized. The state geologist was an ex officio member of that commission until

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* First Biennial Report of the Commissioners of the Geological and Natural History Survey. 1898, p. 24.

1929. In 1931, the administration of the Survey was placed in charge of the Regents of the University.

The geology of about 10,000 square miles in northern Wisconsin has been accurately surveyed. Since 1920, careful road material surveys have been made for contemplated highway construction and maintenance. In the economic series, reports have been published on rural highways, highway construction, the lead and zinc district, Douglas County copper, the Gogebic iron range, the Baraboo iron district, clays and clay industries, limestone road materials, water powers, peat, limestone and marl, underground and surface waters, and molding sands. In the scientific series, reports were published on the geology of north central Wisconsin, abandoned shore lines of eastern Wisconsin, fossils and stratigraphy of Middle Devonic, and sandstones of the Wisconsin coast of Lake Superior.

The study of the lakes has continued to furnish the scientific basis for the determination of the productivity of lakes, especially the sources of their capacity for the production of fish. Reports in the scientific series have been published on dissolved gases, inland lakes, the plankton of Lake Winnebago and Green Lake, lakes of southeastern Wisconsin, polyporaceae, phytoplankton, plankton, and fresh water mollusca.

Reconnoissance soil surveys in the northern part of the state and detailed soil surveys of nearly all of the southern counties have been made, and soil maps and reports published.

Nine reports in the educational series have been issued. One of these, the *Physical Geography of Wisconsin,* has been so popular that a second edition was printed in 1932. Two other reports are now out of print.

Topographic work has been continued until 34 per cent of the State has been mapped. The public has found the six county topographic highway maps very useful. Eleven hydrographic maps of lakes have been published.

While the accomplishments of nearly forty years have been remarkably satisfactory, the net results have not reached the goal of the founders. Botany has been neglected. A much larger sum should have been spent by the State each year in making topographic maps which are so fundamental and necessary for all engineering undertakings. Sufficiently rapid progress has not been made in completing the geological mapping of the State. Publication of results has not kept pace with field work. These

deficiencies are due to lack of funds rather than to failure on the part of the Survey administration to recognize the need. On the whole, the most necessary tasks have been done first. It is quite fitting that a statement of accomplishments of the Survey be made to the Academy because the Academy has had an active interest in the Survey throughout its existence.

AN UNUSUAL PITTING IN NIAGARA LIMESTONE

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The fishermen at Ellison Bay, Door County, Wisconsin, when fishing with set lines for lake trout in lower Green Bay occasionally snag and lift deeply pitted masses of Niagara Limestone. These pitted stones are caught at depths estimated by the fishermen to be from 50 to 70 feet; and when brought to the surface they are reasonably clean and have very little sediment adhering.

The first specimen, acquired about ten years ago, has overall dimensions of about 12 inches long by 8 inches wide by 5 inches thick. (Pl. II, fig. 1) The under side of the stone is covered with a layer of iron oxide about one-sixteenth inch thick which is quite likely an altered layer of iron pyrite. The edges of the specimen, with the exception of the projection in the upper right hand corner, are well rounded. The bedding planes of the rock are parallel to the flat side.

The pits range in size from ½ inch to 1¼ inches in diameter and the surfaces in all are reasonably smooth and the bottoms are spheroidal in shape. In nearly all cases there is evidence of under-cutting. In fact there are several places where the cavity is much larger in diameter than the opening on the surface.

Fig. 2 (Pl. II) shows a "close up" view of the top surface of the stone. In the right hand corner at the border of the picture the inter-communication between the large pits and the round hole is quite evident. Conspicuous also is the very thin bridge between the round hole and the large elongated pit.

Within the last two years a second specimen was obtained (Pl. II, fig. 3). The fisherman who brought it called attention to the curious resemblance of the rock to the human foot and inquired whether it was a fossilized foot. The bedding planes of this specimen are perpendicular to the arch of the "foot" and pass through the heel and the toe. The pits are fairly large and there has also been a dissolution of the limestone above the "heel" of the specimen. On the specimen, at the back side of the picture, at the "ankle" the rock is curved inward very much

as it appears at the "heel". The outer surface of the rock is relatively smooth.

The striking features about both these specimens are the remarkably sharp ridges between adjacent pits. Such features are not formed by abrasion or erosion, but are caused by dissolution of the limestone by some solvent.

A search was made along the shores of Green Bay and Lake Michigan in the vicinity of Ellison Bay for specimens similar to those described, but none was found. Since the specimens just described were lifted from the bottom 50 to 70 feet down, it would seem plausible that they were corroded a long time ago and transported by the Green Bay lobe of the glacier.

During the summer of 1934 a surprisingly interesting example of pitting in the upper surface of rock was noticed in two places on the shore of Lake Michigan.

The first was located on the shore of Sand Bay just north of the highway leading to a fishing harbor and shanty located in the SW¼ of the NE¼ of Section 36, T. 32 N, R. 28 E. The beach sloped very gently into the water and the shallow water extended out for perhaps 500 feet. The stones on the beach were rather flat, with edges rounded, and were imbedded in a matrix of clay and gravel.

At a level perhaps 18 to 24 inches above the lake was a strip of beach about 15 wide and at least 200 feet long where the top surfaces of the stones were pitted as shown in Fig. 4 (Pl. II). Notice that the pits are not so large as those in the slides of the other two specimens. The stones were covered with a dried material whose identity was not determined.

The second place where small pits were discovered was on the solid limestone along the shore in the NE¼ of the NW¼ of Section 28, T. 32 N., R. 29 E. Here again the beach sloped very gently into the water and the shore was rather rough due to the large stones. At a level perhaps 3 to 4 feet above the water level on the upper surfaces of the bedded rock, pits were found similar to those of Fig. 4 (Pl. II), but on the whole somewhat larger.

The two locations on Lake Michigan described above are not exposed to those violent wave actions which impinge on the shores of Green Bay three miles west across the peninsula. Any heavy sea on Lake Michigan would break at least 500 to 1000 feet out at the locations in question.

Fig. 1.

Fig. 3.

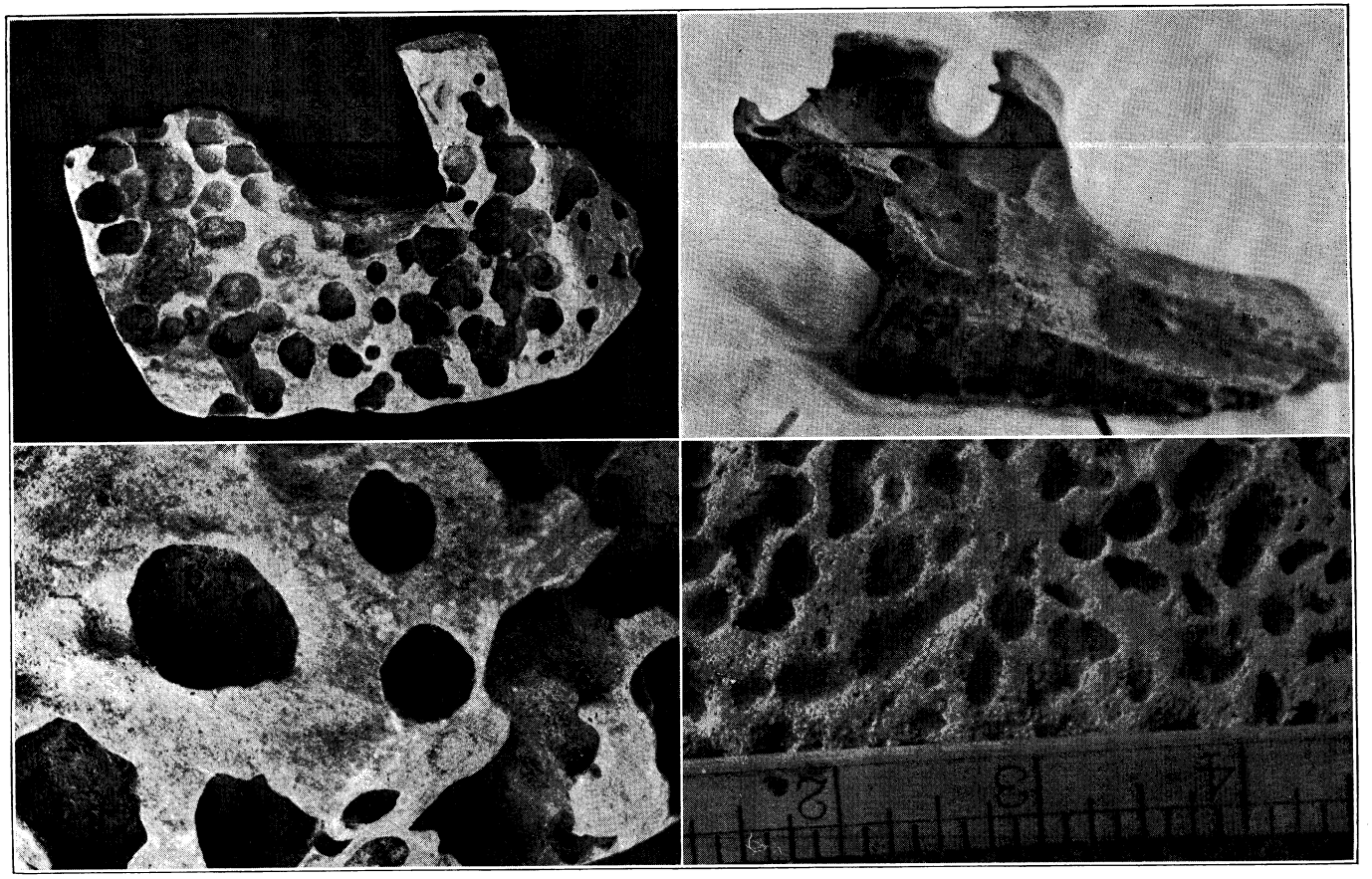

Fig. 2.

Fig. 4.

What caused the pits? It seems plausible to suggest some form of an alga which grows very densely and allows only a slow diffusion of water from within the plant mass to the adjacent clear water. Plants are known to discharge carbon dioxide not only from the upper (and usually green) portion but also from that portion in contact with the soil or with rock on which they are attached. In a dense growth of the plant attached to the limestone, and where carbon dioxide is continuously discharged by the living plant, the water would become quite highly loaded with dissolved gas which would not be diffused readily. The carbonic acid thus formed dissolved the limestone. Such plants would also seem to have grown in stools and gradually spread out until they touched; the borders of contact are the sharp ridges which we see. The plants quite likely grew in shallow water which was reasonably quiet. Violent wave action would soon destroy the plants by the abrasive action of the moving beach material.*

* My colleagues in the departments of botany, zoology, and geology who answered my questions and gave much appreciated advice made the report possible. To them I express my thanks.
Chemical Engineering Department, University of Wisconsin, April, 1935.

PRELIMINARY LIST OF THE HYDRACARINA OF WISCONSIN

PART V*

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Parts I to IV of the *Preliminary List of the Hydracarina of Wisconsin* (Marshall, 1931, 1932, 1933, 1934) recorded sixty-seven species belonging to twenty-two genera. Part IV concluded with six species of the large genus *Piona;* the present paper completes the study of this genus and adds eleven species, one of which is new. In addition to these, two other genera are considered, namely *Hydrochoreutes* and *Acerus,* belonging with *Piona* to the family *Hygrobatidae,* with one species and one new variety, bringing the total number of species described in this paper to thirteen.

The author has recently been fortunate enough to acquire the collections, including type material, of the late Dr. R. H. Wolcott, the eminent American hydracarinologist. In this concluding study of the Pionas it has, therefore, been possible to examine the specimens upon which Wolcott based his descriptions of several species of this genus and to supplement and correct some of the data.

The genus *Hydrochoreutes* is a very small one, closely related to *Piona,* the epimera being very similar. The genital plates carry but six acetabula, three on each side in a row; the plates in the male are close to the posterior end of the body and below them lies a petiole. Palpi and legs are very long and the third leg in the male is modified to serve as a copulatory organ.

The genus *Acerus* is likewise a small one and not common, closely related to *Hydrochoreutes.* Specific determinations depend largely on the characters of the male. The genital plates are similar in the two genera, with three acetabula on each, but there is no petiole in the male and the fourth epimera in the

* In the preparation of this paper, as in the case of Part IV, the author has been greatly assisted by a grant in aid of research of the Society of Sigma Xi. She is also indebted to the Wisconsin Natural History Survey for most of the material from Green Lake and the lakes of Vilas County.

female are more pointed posteriorly. The last leg in the male is distinctive, the four segment being more or less flattened.

1. *Piona setiger* (Wol.)
Pl. VI, fig. 33-37.

The body is elliptical, depressed between the eyes; the average length in the males is 0.70 mm., in the females, 1.10 mm. Colors have not been recorded. The surface is finely striated. The antennary bristles are very long, a character which suggested the specific name. The epimeral groups are moderately separated. The tongue-shaped genital plates of the male extend laterally a little beyond the posterior angles of the fourth epimera and enclose a seminal receptacle which has a broad opening with a small bay where it approaches the inner corners of the last epimeral pair. Each plate bears about fifteen acetabula, one being close to the seminal opening, the others on the outer and lower margins; the united plates leave a broad bay posteriorly, with the anal plate well removed from them. (Fig. 51, Wolcott, 1901, is inaccurate in details.) In the female the genital acetabula, usually fifteen on each side, are arranged in a broken sickle formation, the most anterior one on a small plate with a few fine hairs near the curved bar over the genital slit, the others on a large plate or broken plate. The entire genital area does not extend laterally beyond the limits of the posterior angles of the fourth epimera. The palpi are unusual in that they differ considerably in the papillae in the two sexes; in the female the fourth segment bears two small ones, while in the male there are two moderately long papillae and four smaller ones close to these. Legs in the male are moderately long; the terminal segment of the third is slightly curved and bears small weak claws and several fine hairs, while the fourth segment of the fourth leg has a deep excavation bordered by large stout bristles and a spur on the distal end.

Material has been found in Nebraska, and in Wisconsin in two small pools in Adams and Sauk counties and in a bog in Vilas County.

2. *Piona debilis* (Wol.)
Pl. V, fig. 25-27; Pl. VI, fig. 43, 44.

Dr. Wolcott (1901) described this species from the study of a single male; material in the present collection makes possible

the addition of new data, including a description of the female. The body is elliptical, measuring in the male 0.85 mm., and in the female 1.10 mm. The surface is striated and shows dark blotches on a yellow-green background; the legs and plates are blue and the eyes deep red. The fourth epimera are separated from each other by unusually wide spaces in the male, and the genital plates are somewhat removed from these, except where they are slightly joined in the mid-line. In the male the genital plates resemble those of *P. inconstans;* they are tongue-shaped, each bearing from fifteen to eighteen prominent acetabula, and extend outward from their union in the mid-line more diagonally than in the related species, reaching about as far as the posterior angles of the fourth epimera. They enclose a central shallow circular depression, below which is an area devoid of acetabula. (Wolcott's fig. 46 is inaccurate in details.) In the female the acetabula, similar in appearance and number to those of the male, are placed in a crowded row on sickle-shaped plates, with one or more embedded in the body surface; these plates do not extend laterally as far as the posterior angles of the fourth epimera. The genital slit is surmounted by a short stout curved bar. The posterior inner margins of the fourth epimera show a shallow concavity. The palpi are small, not exceeding the legs in width; the fourth segment carries two papillae. The legs are relatively long but weak, a character which suggested the specific name. The third leg in the male has a long slightly curved terminal segment which bears a long straight claw and unusually long hairs; the fourth leg has a shallow concavity in the fourth segment which is bordered anteriorly by a few short blade-like bristles.

This species has been found in Massachusetts, and in Wisconsin in Lake Mason and in ponds near Cable and Wisconsin Dells.

3. *Piona exilis* (Wol.)

Pl. VII, fig. 45-48.

The elliptical body has an average length of 0.87 mm. in the male and 0.90 mm. in the female; the surface shows coarse irregular lines. The antennary bristles are short. The color is transparent brown, with blue epimera and legs and a patch of red in the center of the body. The epimera are large, approxi-

mate in the male, separated by only small spaces in the female; the inner posterior margins of the fourth are slightly concave. The united genital plates of the male touch the fourth epimera in the mid-line and extend laterally about as far as their posterior angles, as do also those of the female; the genital slit is short and surrounded by an elliptical depression. In the female the long genital opening is flanked by large chitinous plates; the broad tongue-shaped lateral plates extend diagonally out and down from the slit. Genital acetabula are very numerous in both sexes and irregular in number, size and position. The anal plate lies just inside the triangular bay produced by the genital plates; in the male this plate is fused with the latter. The palpi are nearly as long as the body and thicker than the first pair of legs; the third segment is constricted near its base and bears two papillae near its center. The legs are moderately long; in the male the last segment of the third leg is about three-fourths as long as the fifth, is slightly bent and bears weak claws, one of which has a curved piece. The fourth segment of the last leg in the male is moderately long and has a shallow excavation on the fourth segment bordered by several stout spines.

The species has been found in Michigan and Colorado. In Wisconsin it has been collected in Green and Mirror lakes and in the Madison lakes.

4. *Piona pugilis* (Wol.)
Pl. III, fig. 1-5.

In this large species males may attain a length of 1.50 mm. and females 2.00 mm. or more. The body is elliptical, the surface covered with fine wavy lines. On the dorsal side there is a yellowish Y-shaped area, usually with a central red blotch, surrounded by brownish blotches; epimera and appendages are blue, or reddish orange in young specimens. The eyes are ruby. The epimera are heavy, finely reticulated, the groups well separated in the female, with the fourth showing a concave inner posterior border. The broad tongue-shaped genital plates extend laterally well beyond the posterior angles of the fourth epimera, and bear each sixty or more distinct acetabula of various sizes, two of which on each plate are larger than the others. The united plates in the male are fused with the last epimera in the mid-line; the small cleft lies at the upper end of an oval de-

pression. The anal plate in young males is connected with the genital plates by a strip of chitin, but becomes separated from them in older specimens. The palpi are very long, wider than the first pair of legs, with relatively small papillae on the fourth segment. The legs are distinctive and suggested the specific name. The last segment of the first three pairs in the female and the first two in the male are curved and are usually flexed upon the fifth segment; the latter is narrow distally and broad toward the center and bears several bristles. The third and fourth legs of the male are not strongly modified; in the former the last segment is relatively long and bears small weak claws, while the fourth segment of the last leg is also long and has only a shallow excavation.

The species is a common one, being known for Ontario, New York, Michigan and Iowa; in Wisconsin it has been collected in lakes Winnebago, Green, Mirror and Jordan, in the Madison lakes and several of the lakes of Vilas County.

5. *Piona turgida* (Wol.)
Pl. IV, fig. 16-19.

This species is one of the largest of the water mites; females may attain a length of 3.00 mm., males somewhat less. The body is oval, slightly concave between the eyes; the surface is finely striated. The color, according to Wolcott (1901) is "brilliant scarlet-red with dark patches"; only a red Y-shaped dorsal mark has been observed by the author. The epimera are extensive and heavy; in the female the inner posterior border of the fourth is a straight line or only slightly concave. In the male the united genital plates enclose a large broad opening to the seminal pouch, the latter having a broad rounded bay on its anterior and posterior borders and a smaller bay on either side (see fig. 16, Pl. IV, correcting Wolcott's fig. 21). The broad male genital plates, each bearing over fifty acetabula, two of which are larger than the others, extend laterally barely beyond the sharp posterior angles of the fourth epimera; where they unite just behind the genital orifice there is a deep bay and at the mouth of this lies the anal plate. In the female the genital cleft has above it a conspicuous curved bar and is flanked by two narrow delicate flaps (rather than conspicuous broad ones, as shown in Wolcott's figure 20), while over and outside of these are several

rows of short hairs. The irregularly oval genital plates, with acetabula as in the male, come together at their inner borders below the cleft, extend diagonally outward from about the level of the posterior third of the cleft to a point in line with the posterior angles of the last epimera but some distance removed from them. The palpi exceed the legs in width and are stouter in the male than in the female; the fourth segment bears two large slim papillae and two small ones. In the male the third pair of legs, the shortest, end in club-shaped segments which bear short curved claws; these segments, as semen carriers, are often seen on the genital orifice. The fourth segment of the last leg in the male has a deep excavation with a strongly produced posterior tip and many stout spines.

Specimens have been found in Ontario, British Columbia, Michigan and New York; and in Wisconsin in lakes Winnebago and Spooner, the Madison lakes and lakes of Vilas County.

6. *Piona interrupta* Mar.
Pl. IV, fig. 10-15.

This is a large species, oldest females measuring up to 1.70 mm. and males, 1.20 mm. The body is oval, slightly indented between the eyes; the surface is covered with fine lines and small chitin dots. The dorsal surface shows a red or yellowish Y-shaped mark surrounded by dark blotches; the eyes are red and the plates blue tinged. The epimera are finely reticulate; the fourth pair in the female are relatively narrow on the median side and show a long concave inner posterior border. The genital area in the male closely resembles that of *P. turgida*; the broad plates, however, each bearing over fifty acetabula, extend laterally beyond the acute angles of the fourth epimera and the large broad seminal orifice is shaped somewhat differently, the anterior bay being deeper and the lateral ones having an acute angle. The anal plate lies at the mouth of the deep bay formed by the plates back of their union behind the seminal pouch. In the female the genital cleft is surmounted by a conspicuous curved bar, beween the ends of which and the genital plates on each side are seen a few fine hairs. The broad genital plates bear somewhat smaller and more numerous acetabula than in the related species; they are more or less deeply indented on the inner median borders, and here no acetabula are found, a char-

acter which suggested the specific name. These plates extend laterally beyond the limits of the fourth epimera, from which they are widely separated, and their inner anterior borders start at about the level of the angles but do not meet behind the cleft; on their inner posterior borders on each side are three or four fine hairs, either on the plates or on separate small plates. The palpi are somewhat slimmer than in *P. turgida,* but are wider than the legs, and the fourth segment bears two long papillae and two small ones. The third leg in the male ends in a club-shaped segment, a little shorter than in the related species; the fourth segment of the last leg is very similar in the two species, being deeply excavated, with a large posterior spur and many bristles.

The species is abundant and has been taken at various depths from the surface to twelve meters. It has been found in British Columbia, Ontario, Montana and Michigan. In Wisconsin collections have been made in Mason and Green lakes, several lakes of Vilas County and in ponds near Oshkosh and in Adams County.

7. *Piona americana* Mar.
Pl. V, fig. 20-24.

This species closely resembles *P. turgida* and *P. interrupta,* especially in the male, but it is smaller and differs from them in details of the ventral plates and appendages. It is one of the very few American species of water mites whose developmental stages are known (Marshall, 1929). Largest females attain a length of 1.35 mm., males, 1.20 mm. The body is oval, the surface covered with very fine striae and tiny dotes of chitin. The antennary bristles are short and fine and on small papillae. The dorsal surface shows a yellow or reddish Y-shaped mark surrounded by dark blotches. The last epimeral groups do not quite join in the male; in both sexes the fourth epimera show a deep concavity on the posterior inner borders and close to them lie the genital plates. The latter are oval and bear each from thirty to forty indistinct acetabula, two of which on each side are slighly larger than the others. In the male the inner margins of the genital plates meet to surround a seminal pouch, the opening of which is very large, inverted trifoliate in form. The genital plates in both sexes extend laterally only a little beyond the

posterior angles of the fourth epimera. In the female the genital plates are more closely approximated than in the related species; they barely touch on their inner posterior borders. The anchoral bar above the female genital opening is small. The palpi are broader than the first pair of legs; the fourth segment bears one large papilla and three smaller ones. In the male the last segment of the third leg is short and curved, broad at the distal end, and bears a claw transformed into a long delicate hook; these legs are often found, as in the two related species, with their tips together over the opening of the seminal pouch. The fourth segment of the fourth leg has a posterior spur carrying long hairs, and deep concavity bordered by rows of short blade-like spines.

Specimens were found in large numbers in three lakes near Minocqua and also in Green Lake, Wisconsin. Individuals found in Alaska, originally identified by the author as *P. turgida,* are now seen to represent this species.

8. *Piona constricta* (Wol.)
Pl. III, fig. 6-9.

The body is elongate, large specimens measuring 0.90 mm. in the male and 1.70 mm. in the female. The anterior border is emarginate between the eyes and constricted behind them; the posterior end is elongated (not "smoothly rounded posteriorly," as stated by Wolcott, 1901, p. 222). The surface shows fine lines. Antennary bristles are conspicuous. Young specimens are deep red, while older ones are brownish red; the legs are red and the eyes ruby. The epimera in the female are relatively small and well separated; in the male they are large with considerable spaces between the inner ends of the two anterior groups. The posterior inner margins of the fourth epimera are distinctly concave, especially in the male. The united genital plates in the male are in contact with the fourth epimera in the median line and also at their posterior angles, extending laterally a little beyond these. There is present a seminal pouch having a large broad opening with a small anterior bay; from this the genital plates, each bearing nine or ten large acetabula, extend laterally leaving scarcely any bay. In the female the genital area is some distance from the last epimera; a sickle-shaped plate flanks the posterior two-thirds of this area on either

side, each plate bearing eight to ten large acetabula and several fine hairs. The palpi are rather short, a little wider than the first pair of legs, relatively smaller in the female than in the male; the fourth segment bears two papillae of equal size. The species name refers to the slight constriction in the fifth segments of the legs. The last segment of the third leg of the male is enlarged and curved distally and bears curved claws. The fourth segment of the last leg is very broad and bears a deep concavity and spur, with numerous bristles.

Specimens have been found in Ontario, Michigan, Nebraska and Montana; and in Wisconsin collections have been made in the Madison lakes and in lakes of Adams and Vilas counties.

9. *Piona spinulosa* (Wol.)

Pl. VI, fig. 38-42; Pl. VII, fig. 53.

One of the smallest of the Pionas, this species seldom exceeds 0.50 mm. in length, males and females being of about the same size. The body is broadly elliptical; the dorsal surface shows dark patches on a transparent background, with sometimes a red patch. The epimera cover the greater part of the ventral surface, the groups close together even in the female, the fourth showing a sharp posterior angle. The genital areas are also large and reach the posterior border of the body in young individuals as shown by Wolcott (1901, fig. 24, 25; the latter is here reproduced as fig. 39). The genital plates are similar in form in both sexes, being broad and tongue-shaped, each bearing from twenty to thirty scattered acetabula, very variable in size and arrangement. The united plates in the male enclose a depressed area with a distinct anterior border in which lies the genital opening. The anal plate lies close to the genital plates. The maxillary shield is very broad. The palpi are relatively long; the second segment is rather stout, especially in the male, and the fourth bears two small papillae. The legs are long and heavy; swimming hairs and spines are relatively few but the latter are stout. In the first two pairs the terminal segments have very narrow proximal ends, while the flexor side is convex, characters especially pronounced in the male. In the third leg the sixth segment is short and one of its claws bears a very long process. In the last leg, the fourth segment bears a deep con-

cavity with short spines and several long ones, together with three swimming hairs on the distal end.

Specimens have been found, often in large numbers, in Massachusetts, Michigan, Illinois, Louisiana and Indiana; and in Wisconsin in lakes Spooner, Wingra and Mason and a pond at Montello.

10. *Piona carnea* (Koch)
Pl. V, fig. 28-32.

A cosmopolitan species, this is the first record of its occurrence in this country. The body is elongated, the anterior end strongly protruding. The largest males found measured 1.85 mm., the females, 2.00 mm. The surface is covered with fine lines and small circles. The dorsal surface shows large dark blotches on a yellowish background; the eyes are large, magenta colored, and the legs are bluish with orange tips. The epimera are heavy and brownish; the fourth in the male are separated from each other by a larger space than is usual in this sex, and their posterior angles in both sexes are very long and acute. The genital areas are small; the plates bear each from eighteen to twenty very distinct acetabula and extend laterally but little beyond the posterior angles of the fourth epimera. In the male the rounded plates are joined by a narrow strip both above and below a large seminal opening; the latter is nearly circular with a narrow bay where the plates touch the epimera in the midline. In the female the genital plates, irregularly pyriform, extend laterally out from the posterior end of the genital slit; a large curved bar surmounts the slit, between which and the anterior margins of the plates are several fine scattered short hairs. The maxillary shield and the palpi are unusually small, the latter being narrower than the legs; the fourth palpal segment bears on the flexor side two long hairs close to two slight papillae. The legs are all shorter than the body and well provided with swimming hairs. The first two pairs (and the third in the female) bear very large claws. The third leg in the male is the shortest and narrowest; its end segment is slightly curved and bears reduced claws and many fine hairs. In the fourth leg of the male the first three segments are short and stout; the fourth has a deep excavation bordered by many short

stout bristles and ends in a spur with long hairs, while the fifth and sixth segments are weak.

This species is reported from all parts of Europe and from Siberia, Turkestan and Palestine. In Wisconsin several individuals were found in Panto Lake, Vilas County. Two males found in Alaska and described by the author (Marshall, 1924) as a new species, *P. neocarnea,* are found on re-examination to be true *P. carnea;* hence the former name becomes a synonym and must be discarded.

11. *Piona wolcotti* nov. spec.
Pl. VII, fig. 49-52.

The new species, one of the largest of the Pionas, is known for the male only. The body is elliptical, lowest at the anterior end, slightly protruding between the eyes. The largest of the three males found measured 1.50 mm. in length. The body is covered with very fine lines and minute points. The antennary bristles are very small. The general color is deep orange to red, lighter at the anterior end, with appendages and plates dull blue. The eyes are small. The epimera are heavy; the anterior groups lie close to the third and fourth pairs, while the latter are in contact on their inner borders and have acute posterior angles. The male genital plates are distinctive; they are completely fused to form a broad triangular area well within the bay made by the four epimera, touching the latter only slightly at the anterior end. The genital opening is surrounded by a considerable area which is dotted with many fine hair papillae. The genital acetabula are distinct and numerous, with two on each plate larger than the others. The united plates leave a small deep bay on the posterior median line in which is situated the anal plate. The palpi are slim but exceed the legs in width; the fourth segment bears two large and two small papillae and has also a large spur armed with a peg on the distal end, inner side. The legs are moderately long, all exceeding the body in length; swimming hairs are coarse and abundant on the second and third, absent on the first, scanty on the fourth, while bristles are abundant on all legs. The third leg has a long slim terminal segment with a knee on the proximal end which causes it to lie in a slightly different plane from the other segments; it ends in very small claws. In the fourth leg the segments diminish in width suc-

cessively from the first, so that the sixth is very slim, with small claws; the fifth segment is the longest. The fourth segment of this leg has a shallow concavity bordered by bristles, both hair-like and flattened, while a row of seven large bristles is set on the convex side.

This new species is given the name of the late Dr. R. H. Wolcott who did the first important work on the Pionas in this country. Specimens were found in Little John and Star lakes, Vilas County and in Three Lakes, Oneida County.

12. *Hydrochoreutes ungulatus* (Koch)
Pl. VIII, fig. 54-57.

This is a cosmopolitan species. Males measure up to 0.60 mm. in length; the females are much larger and may reach a length of 1.70 mm. The body is broad, in the male somewhat angular, in the female oval. The antennary bristles are long. The surface has fine lines; dark blotches show on a background of delicate yellow or blue, with a pale yellow or red T-shaped mark showing dorsally. The epimeral groups are moderately separated and the genital plates are well back of these. The latter in the female are slightly lunate, the same length as the slit and carry the three large acetabula of each side, together with fine hairs. In the male the genital plates lie within a deep recess at the posterior end of the body; they are broadly lunate and the three acetabula of each side lie in a crowded row near the long slit. Below these is a conspicuous petiole, as long as the slit; it ends in a tooth and has on each side a shorter protecting sheath. The palpi are slender, about as long as the body in the female, exceeding it in the male; the fourth segment is the longest and bears several hairs and inconspicuous papillae. The legs are slender, much longer than the body. In the third leg of the male, the fourth segment has a large papilla near the center which is armed with a large sword-shaped spine inserted laterally, while the distal end bears a still larger sickle-shaped spine with a process at its base.

The species is found in all parts of Europe and is reported for Siberia. It is probably widely distributed in this country, since it has been collected in Maine, Michigan and California. In Wisconsin it has been found in lakes Mason, Spooner and Green and in two lakes in Vilas County.

13. *Acercus torris americanus* nov. var.
Pl. VIII, fig. 58-61.

A small number of individuals (one male, four females) in the author's collection bear a close resemblance to the cosmopolitan species, *Acercus torris* (Müll.), but are larger (male, 0.80 mm., largest female, 1.30 mm. in length) and differ from it in certain details, especially in the palpi, sufficiently to justify the erection of a new variety, *A. americanus* for them. As in *A. torris,* the body is oval, emarginate over each eye and at the posterior end, with a surface indistinctly striated, showing dark blotches on a pale orange red background, numerous fine hairs and two small chitin spots anterior to the center, dorsally. Only one pair of antennary bristles are present, instead of two; but epimera, genital plates and legs present only differences in detail from the parent form. The epimera are relatively small in the female but cover the greater part of the ventral surface in the male; the posterior prolongations of the fourth form right angles in the female but are rounded in the male. The three genital acetabula in the female lie on a triangular plate nearly as long as the genital opening; in the male they lie on broader united plates which fill most of the bay left by the approximated fourth epimera. The palpi are a little wider than the legs and slimmer than in *A. torris,* due to the greater length of the second and fourth segments; the first three segments bear heavy bristles, the fourth has two small papillae midway of the flexor surface and many fine hairs on the extensor side, with a peg on the distal end, while the fifth segment ends in three finger-like processes. The legs are longer than the body, with swimming hairs on the last three pairs. In the male the third leg is the shortest; the fifth segment is about as long as the sixth and bears many short hairs and a pair of weak claws. The fourth leg of the male is the longest and very distinctive: the first three segments are very short; the fourth is longer, very broad and flat and thickly beset on its margins with long fine hairs; the fifth segment, the longest, is slightly curved and has a spur armed with a peg on the distal end.

The new variety has been found in Illinois, and in Wisconsin in the Madison lakes and a pool near Jordan Lake.

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Plate III

1. *Piona pugilis*, ventral surface, old female
2. *Piona pugilis*, segments 5, 6, leg I, male
3. *Piona pugilis*, middle segments, leg IV, male
4. *Piona pugilis*, genital area, old male
5. *Piona pugilis*, palpus, female
6. *Piona constricta*, genital area, old female
7. *Piona constricta*, left palpus, outer side, female
8. *Piona constricta*, segment 6, leg III, right, male
9. *Piona constricta*, genital area, male

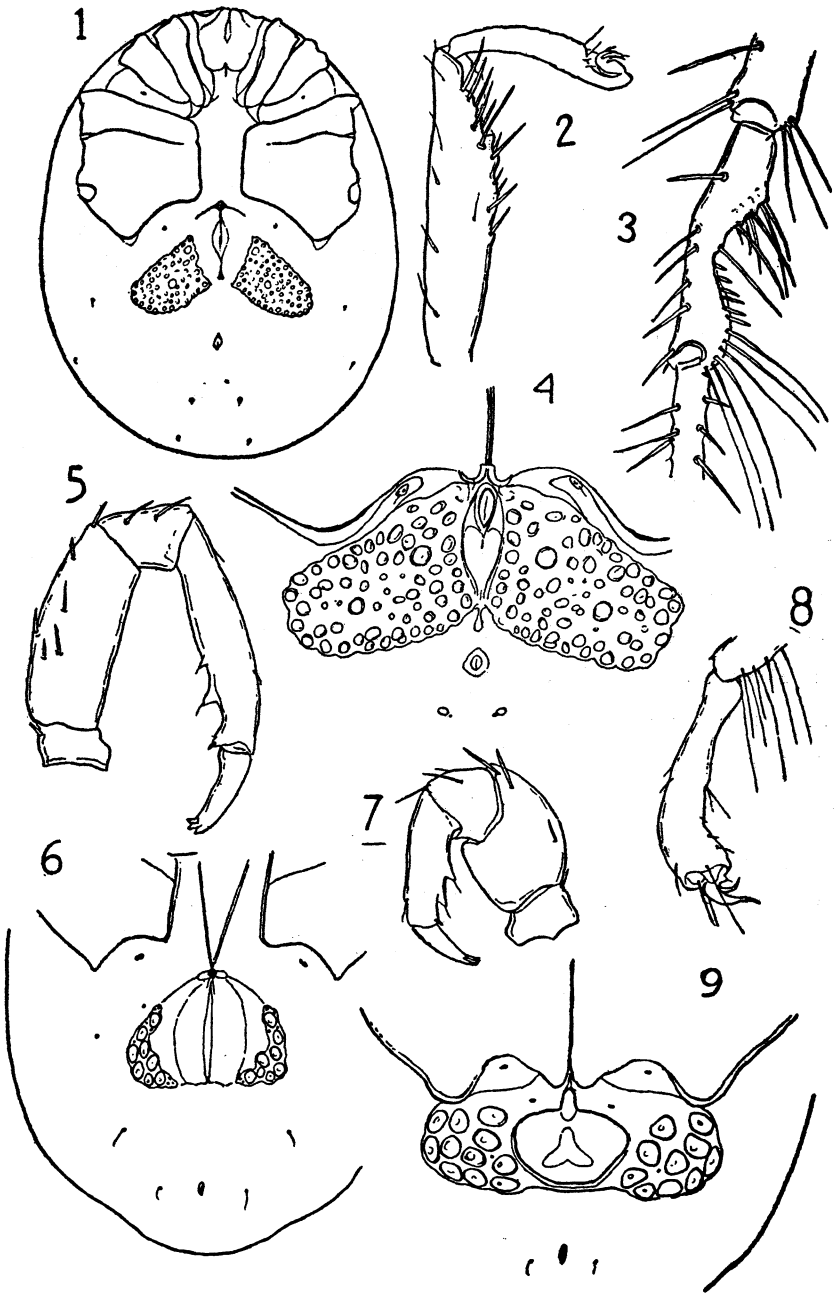
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Plate IV

10. *Piona interrupta*, ventral surface, female
11. *Piona interrupta*, right palpus, inner side, male
12. *Piona interrupta*, segment 4, leg IV, right, male
13. *Piona interrupta*, legs III, male, on genital orifice
14. *Piona interrupta*, segment 6, leg III, male
15. *Piona interrupta*, ventral surface, male
16. *Piona turgida*, genital area, male
17. *Piona turgida*, segment 6, leg III, right, male
18. *Piona turgida*, genital area, female
19. *Piona turgida*, right palpus, inner side, male

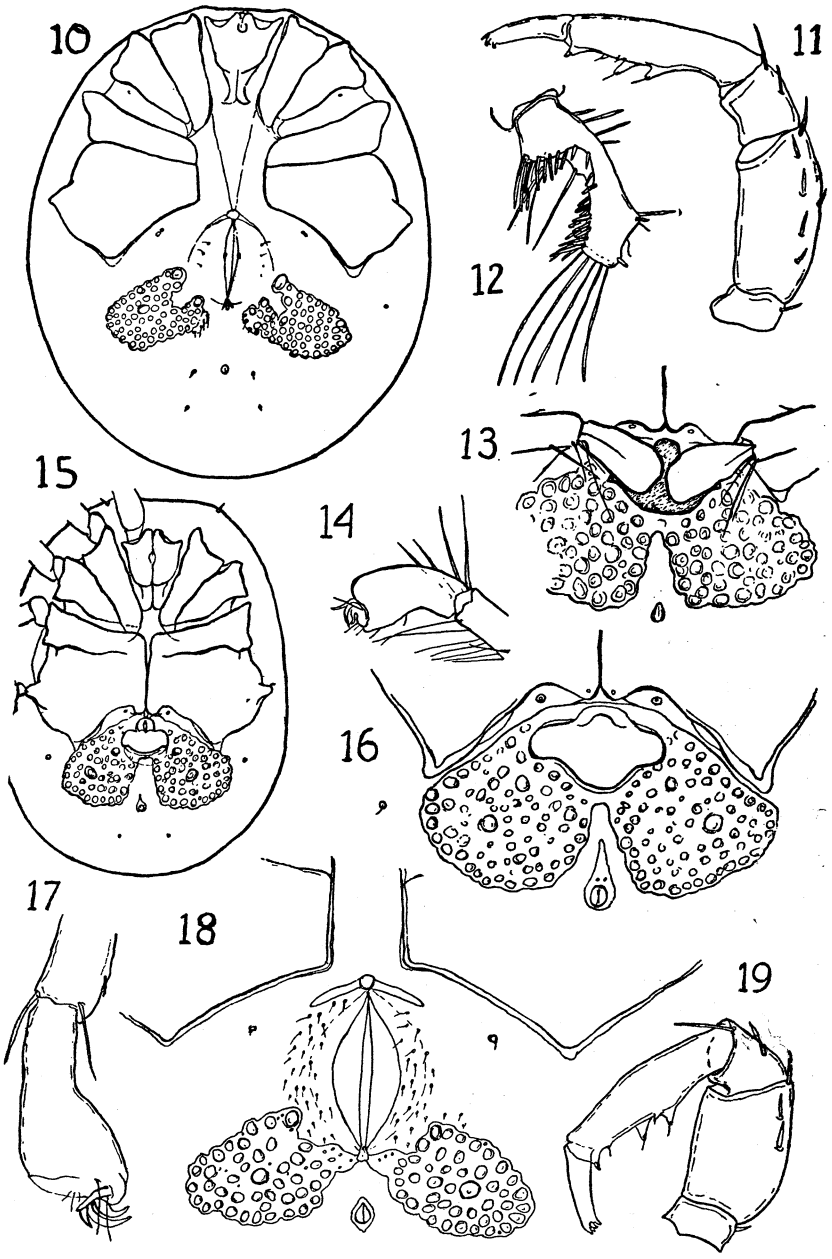
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Plate V

20. *Piona americana*, genital area, female
21. *Piona americana*, segment 4, leg IV, male
22. *Piona americana*, ventral surface, male
23. *Piona americana*, left palpus
24. *Piona americana*, segment 6, leg III, male
25. *Piona debilis*, segment 4, leg IV, male
26. *Piona debilis*, segment 6, leg III, male (from Wolcott)
27. *Piona debilis*, left palpus, female
28. *Piona carnea*, middle segments, leg IV, left, male
29. *Piona carnea*, genital area, female
30. *Piona carnea*, ventral surface, male
31. *Piona carnea, segment* 6, leg III, right, male
32. *Piona carnea*, right palpus, female

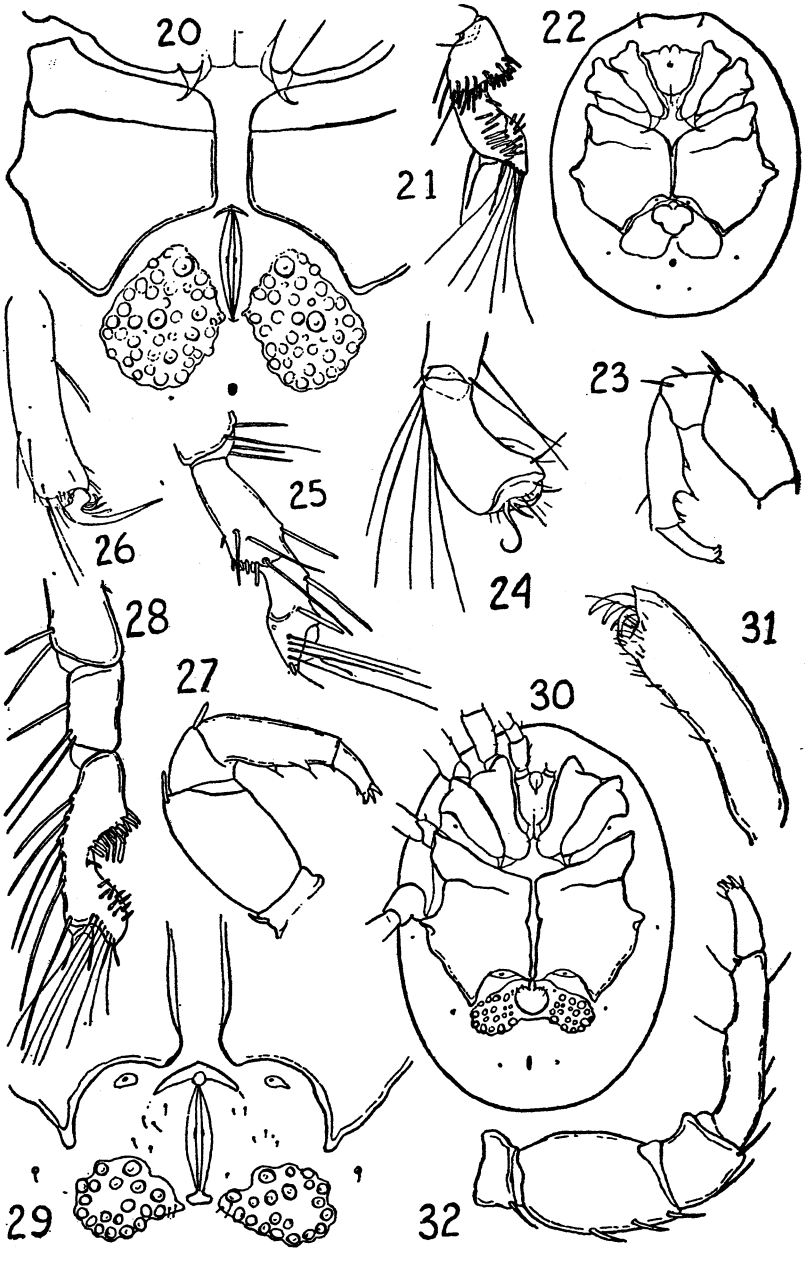
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Plate VI

33. *Piona setiger*, right palpus, outer side, female (from Wolcott)
34. *Piona setiger*, segment 6, leg III, male (from Wolcott)
35. *Piona setiger*, left palpus, outer side, male (from Wolcott)
36. *Piona setiger*, ventral surface, male
37. *Piona setiger*, ventral plates, female
38. *Piona spinulosa*, segments 5, 6, leg III, male
39. *Piona spinulosa*, ventral surface, young male (fromWolcott)
40. *Piona spinulosa*, right palpus, inner side, male (from Wolcott)
41. *Piona spinulosa*, segment 4, leg IV, male (from Wolcott)
42. *Piona spinulosa*, genital area, old female
43. *Piona debilis*, ventral surface, male
44. *Piona debilis*, genital area, female

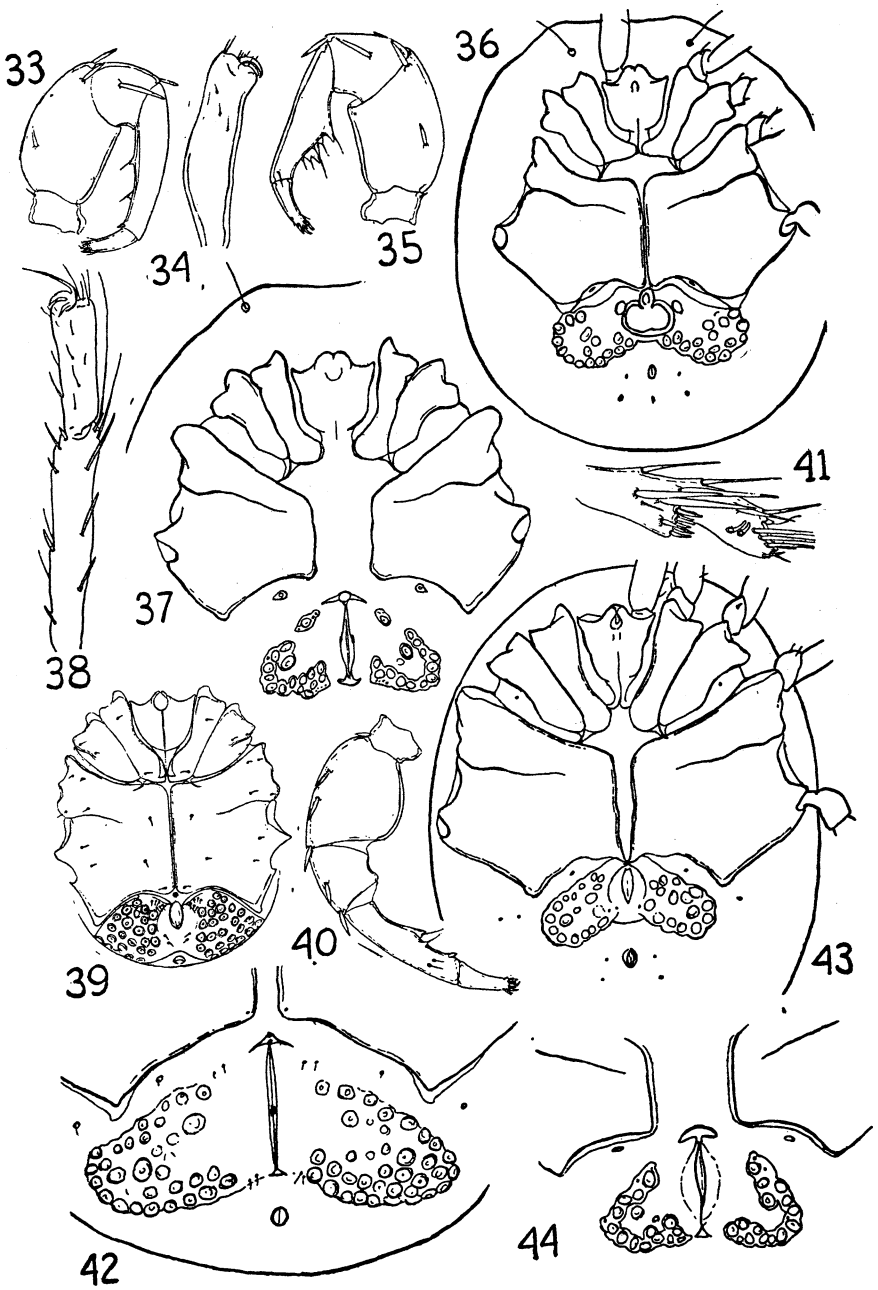
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Plate VII

45. *Piona exilis*, right palpus, outer side, male
46. *Piona exilis*, genital area, female
47. *Piona exilis*, segment 6, leg III, male (from Wolcott)
48. *Piona exilis*, ventral surface, male
49. *Piona wolcotti*, segment 6, leg III, right, male
50. *Piona wolcotti*, ventral surface, male
51. *Piona wolcotti*, right palpus, male
52. *Piona wolcotti*, segment 4, leg IV, right, male
53. *Piona spinulosa*, segments 5 and 6, leg I, right, male

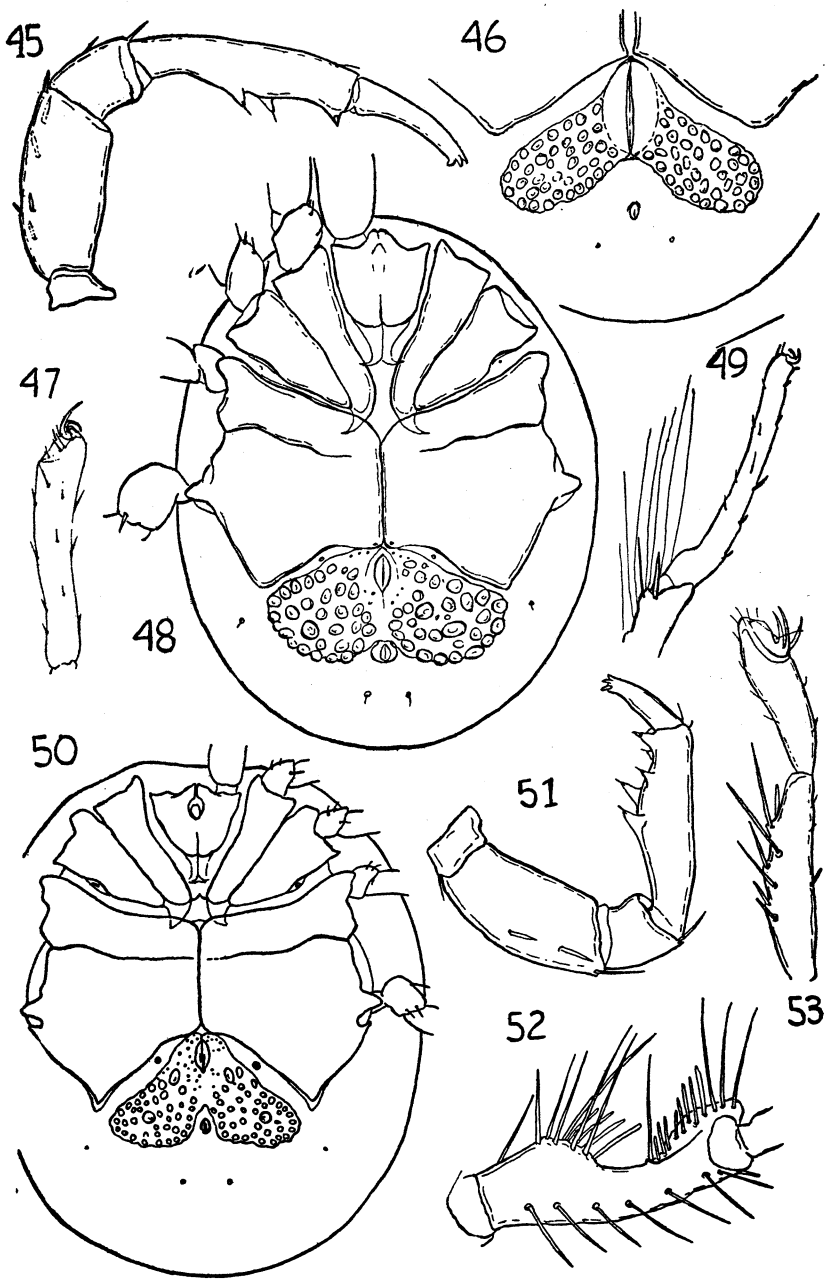
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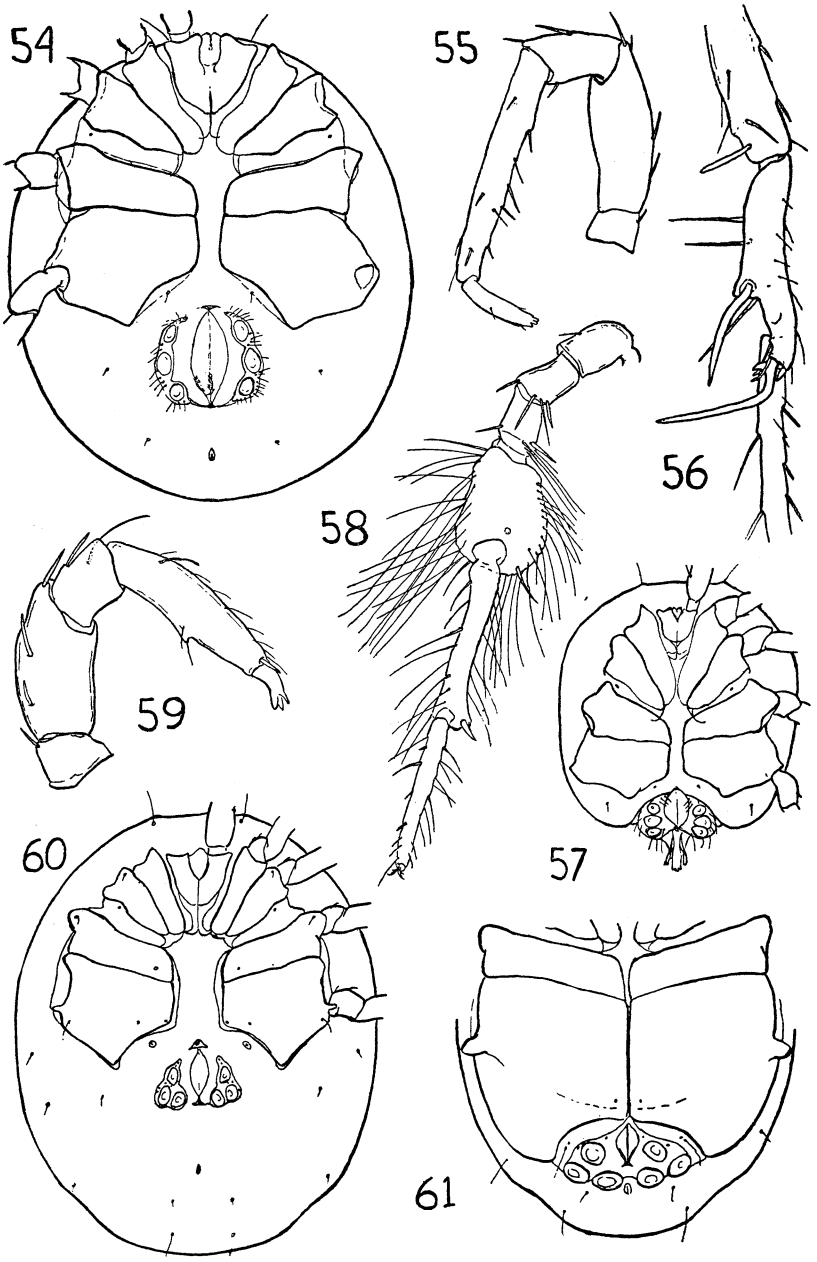
Plate VIII

54. *Hydrochoreutes ungulatus*, ventral surface, female
55. *Hydrochoreutes ungulatus*, left palpus, male
56. *Hydrochoreutes ungulatus*, middle segments, leg III, left, male
57. *Hydrochoreutes ungulatus*, ventral surface, male
58. *Acercus torris americanus*, leg IV, right, male
59. *Acercus torris americanus*, left palpus, inner side, male
60. *Acercus torris americanus*, ventral surface, female
61. *Acercus torris americanus*, posterior ventral surface, male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GEORGE SANDY'S *RELATION*

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Evidence is not hard to find for the popularity soon achieved by George Sandys' *Relation,* his account of a journey to Turkey, Egypt, the Holy Land, and the "Remote parts of Italy, and Ilands adjoining," published in 1615. By 1670 the book had gone through seven editions, and parts of it had been included by Samuel Purchas among *His Pilgrimes.* During the seventeenth century the book was held in particular esteem for the account it gave of the East and for its picture of Jerusalem. It was this that Fuller most emphasized in his sketch of Sandys in the *Worthies*:[1]

> He proved a most accomplished gentleman, and an observant traveller, who went as far as the sepulchre at Jerusalem; and hath spared other men pains in going thither by bringing the Holy Land home to them; so lively is his description thereof, with his passages thither, and return thence.

Sandys set out on his travels in 1610, just a little more than a hundred years after Wynkin de Worde published, among the earliest printed books in England, his *Informacon for Pylgrymes unto the Holy Land.* In the course of that eventful century both the English attitude toward travel and the English book on travel passed through a number of significant phases.

Stated in its simplest terms, what had begun as an experiment, the practise of the upper classes of sending their sons abroad as a part of their education, grew to be a custom, and finally by the middle of the seventeenth century had become a definitely set and labelled system, the "Grand Tour." In the course of this evolutionary process certain distinguishable types of travellers appeared. No Jacobean traveller better represents the crystallization of a particular type than Sandys, but to understand that type and to appreciate the qualities that distinguish his account from those of most of his contemporaries it is necessary to understand the part played by travel and travel literature in the whole Renaissance movement in England.

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[1] Thomas Fuller, *The History of the Worthies of England,* (London, 1840), III, 434.

The pilgrim had been the important traveller of the Middle Ages, but just about the time Wynkin de Worde was addressing his very practical advice to the pilgrim, not on how to achieve the most complete spiritual satisfaction from his journey but on how to travel with the greatest comfort and pleasure, the pious motives of the pilgrim began to be questioned. Erasmus in his *Colloquies* asserted that it was nothing but the love of change that sent the clergy off to Jerusalem. People went to entertain themselves and to be able to entertain their friends on their return with stories of their adventures. He did not consider travel in itself harmful, but he did feel that pilgrimages made without genuinely pious motives were a dissipation.[2]

During the sixteenth century men's minds began to turn to objectives for travel. The pilgrim did not disappear from the scene although he was apt to leave little record of himself unless he went to Jerusalem. Evelyn was told that during the year of the Jubilee, 1600, twenty-five thousand five hundred women visitors were registered at the pilgrim's hospice of the Holy Trinity at Rome and forty thousand men.[3] The growth of Protestantism in Europe accounts for much of the decrease in pilgrimages. Fynes Moryson, one of the most indefatigable of English travelers, who visited Jerusalem in 1596, was very careful to explain at the beginning of his account that his motives were not those of the pilgrim:

> And first I thinke good to professe that by my journey to this City, I had no thought to expiate any least sinne of mine; much lesse did I hope to merit any grace from God; but when I had once begun to visit forraigne parts, I was so stirred up by emulation and curiosity, as I did never behold any without a kind of sweet envy, who in this kind had dared more than myself. Thus affected, I thought no place more worthy to be viewed in whole world, then this City, where howsoever I gave all divine worship to God, and thought none to be given to the places, yet I confesse that (through the grace of God) the very places strucke me with religious horrour, and filled my mind prepared to devotion, with holy motions.[4]

Humanism was the new force urging the best minds to go forth to learn at first hand the best that was being thought and said in the world. Italy, with its preeminent universities whose

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[2] Desiderius Erasmus, *Twenty Select Colloquies out of Erasmus Roterodamus*, By Sir Roger L'Estrange, "The Religious Pilgrim," (London, 1711).

[3] John Evelyn, *Diary of John Evelyn*, Ed. by Wm. Bray, (London, 1879), I, 199.

[4] Fynes Moryson, *An Itinerary Containing his Ten Yeeres Travell through the Twelve Dominions of Germany, Bohmerland, Sweitzerland, Netherland, Denmarke, Poland, Italy, Turky, France, England, Scotland, & Ireland*, (Glasgow, 1907), II, 1.

fame had spread northward to excite men in the newly revived interest in Greek literature and thought, was the supreme magnet, for there the young, eager minds of Germany and England found a charm of intellectual companionship which their own countries could not offer. Erasmus had been among the earliest caught in the spirit, and, stimulated by the associations he formed there, he had been tempted to end his days in Rome. Selling, Latimer, Grocyn, Tunstall, Colet, and Lily studied in Italy, returned to transform Oxford into a great center of Greek learning and to introduce into England the Renaissance respect for a foreign education. All that they brought back was good because they were men of vision and character, able to instil into their followers the highest ideals of travel for the sake of intellectual enlightenment.

But learning in the sense of scholarly pursuits was not the only educational motive that sent young Elizabethan gentlemen to the continent. As an essential move toward achieving his ambition to become a power in European politics, Henry VIII had set out to establish a system of close relationships with the important nations of Europe. Such intercourse could not be successfully carried on without ambassadors, and to fill these roles he needed men with special training. The ambitious courtier soon realized that a good education and a knowledge of foreign lands and of foreign tongues was of great value in gaining important commissions and preferment at court. Diplomatic appointments were given to such men as Sir Thomas Wyatt, whose education had been perfected in France and Italy; to Sir Nicholas Wotton, who had lived in Perugia, and graduated doctor of canon and civil law; and to Anthony St. Lieger, who "when twelve years of age was sent for his grammar learning with his tutor into France, for his carriage into Italy, for his Philosophy to Cambridge, for his law to Gray's Inn: and for that which completed all, the government of himself, to court."[5]

In the wake of this increasing number of ambassadors, who had taken their foreign travel seriously as training for diplomatic service, followed other young gentlemen of fashion who sought the protection of these official suites to travel in pursuit of a rather more informal education. Among these were such young bloods as George Boleyn, Nicholas Carew, and Henry

[5] David Lloyd, *State Worthies*, (London, 1766), I, 99

Fitzroy. They returned with a new brand of sophistication, new apparel, new habits in eating and drinking, and with a general distaste for their own country. They were among the first "Italianate" Englishmen.

Books of advice to young men about to travel began to appear during the last quarter of the sixteenth century. According to Turler, whose volume of precepts for travel was translated into English and published in London in 1575 under the title of *The Traveiler of Jerome Turler*, this type of book originated in Germany. This particular volume seems to have been the first of its sort to appear in England. The Germans were quite as ardent travellers as the English and likewise accepted the Renaissance ideal of travel as a real duty to the State as well as the final means of achieving complete intellectual manhood. This theme was enlarged upon both in other books coming out of Germany and in similar ones produced at home. The correspondence of such men as Lord Burghley, Fulke Greville, and Sir Philip Sidney shows how seriously these aims of travel were felt by men of rank. Particularly pertinent as an illustration of the force of these two prevailing ideals are the two letters written by Sir Philip Sidney to his brother Robert who was travelling on the continent in 1580, the one dealing with the importance of his studies and the other with his responsibilities to his country. In the latter he wrote

> Your purpose is being a Gentleman borne, to furnish your selfe with the knowledge of such things, as maie be serviceable to your Countriee, and fitt you for your calling. . . . You cannot tell what the Queene of England is able to doe, defensivelie, or offencivelie, but by through compareing what they are able to doe, with whome shee is to bee matched. This therefore is one noteable use of travaile, which standes in the mixed and correlitive knowledge of all leagues, betwixt Prince and Prirce, the topografical description of eache Countrie, how the one lyes by scituacion to hurte or helpe the other, howe they are to the sea well harboured or not, howe stored with shippes, howe with Revenewe, how with fortifications and Garrisons, howe the people warlicklie trayned or kept under, with manie other such condicions which as they confusedlie come into my mynde, so I for want of leasure sett downe.[6]

It became practically obligatory for the young traveller to keep a journal; it was one of the things that almost all "Directions" and advisors insisted upon. One of the forms that this

[6] Sir Philip Sidney, *Complete Works*, Ed. by Albert Feuillerat, (Cambridge, 1923), III, 125.

"Relation" might take was that of a series of formal letters sent back to keep worrying parents informed of the son's progress. That this duty often became burdensome is indicated by the apologetic tone of some of the letters. Francis Davison, son of the queen's secretary, wrote on one occasion to his father to say, "I am ashamed of myself that I have no new relation or discourse ready of some of these parts of Italy." And later

> Touching giving some proof to yourself and others, whether I have made the same use of our travel in Italy that it pleased you to think I did in Germany, I have gathered and observed divers particulars both in Tuscany, and some other places, which I forbare to reduce into an absolute discourse before I hear how my Lord accepted my other.[7]

In the case of Sir John Harington, the "relation" took the form of a weekly letter to Prince Henry informing him of the countries he was passing through and of all the news worthy of the prince's ear. A third form of "relation", the one with which this study will be most concerned, was that which was preserved as a journal and edited as a book upon the traveller's return.

These various types left their impress upon the then crystallizing form of the travel book of the period. Much that strikes us as stilted in the observations of even the most markedly individualistic or even eccentric traveller bears the stamp of a highly conventionalized pattern of procedure to be followed in recording observations of a newly visited country. Sandys' own work affords a very adequate illustration of this point.

Along with the thorough establishment of the vogue of travelling to become a "compleat person" the Elizabethan Age worked out a highly rationalistic theory of travel. As an educational force it was regarded with awe. Since foreign countries were judged partly by the criticisms which appeared in travel books, it was the obligation of the traveller to set himself up as a skilled observer engaged almost in a solemn duty to his country. It is in this high sense of public duty and in its ethical and educational sides that the strength of the Renaissance theory of travel can be seen. The traveller, in theory, animated as he was by a stern sense of duty to his country, could never be a pleasure seeker. There was no place in the theory for even the most cultivated of dilettantes. The dilettante traveller did appear, but he did not leave accounts of his idle adventures; he

[7] Francis Davidson, *Davidson's Poetical Rhapsody* (London, 1602), Biographical Notice, XXIII.

might almost have been lost in oblivion had he not been immortalized by his scornful critics. Travel as an amusement was not acceptable to the English Renaissance mind.

No one will believe that these travellers failed utterly to share with travellers of all time the perennially human curiosity to see the world, to know what other men are like, to follow the lure of the sound of far-off place-names, or to taste the magic of the sea. But whatever feelings of this sort these men may have had, they carefully stifled them when they began to write. One has to search far to find any one of them admitting that he had actually derived pleasure as well as profit from his journeys. Fynes Moryson did not go this far, but he did preface his work with an unusually frank apology for his shortcomings:

> Again, for the work in generall, I professe not to write it to any curious wits, who can indure nothing but extractions and quintessences: nor yet to great statesmen, of whose reading I confesse it unworthy: but only to the unexperienced, who shall desire to view forraign kingdoms.[8]

Thomas Coryat, whose *Crudities* were published in 1611 and whose pages were filled, consciously or unconsciously, with a fine relish for life, came nearest to making a complete revelation on the score of pleasure. In his Epistle to the Reader he undertook to explain the motives which produced his

> observacions whereby I may the better encourage Gentlemen and lovers of travell to undertake journeys beyond the seas. . . . Of all the pleasures in the world travell is (in my opinion) the sweetest and most delightful. For what can be more pleasant than to see passing variety of beautiful Cities, Kings and Princes Courts, gorgeous Palaces, impregnable Castles and Fortresses, Towers piercing in a manner up to the cloudes, fertill territories replenished with a very Cornucopia of all manner of commodities . . . tending both to pleasure and profit, that the heart of man can wish for: flourishing Universities (whereof only Germany yeeldeth no lesse than three and twenty) furnished with store of learned men of all faculties, by whose conversation a learned traveller may much inform and augment his knowledge. What a singular and incomparable comfort it is to conferre with those learned men in forraine Universities and noble Cities, whose excellent workes we reade in our private studies at home.[9]

Coryat was quite aware that his interests were much closer to those of the antiquarian than they were to those of the student

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[8] Moryson, *op. cit.*, XXI.

[9] Thomas Coryat, *Coryat's Crudities* (Glasgow, 1905), I, 8.

of government. In answer to criticism launched against him on that score he defended himself by declaring:

> It hath bene oftentimes objected unto me since my coming home, by certain Gentlemen of eminent note, and as it were laid in my dish as a choaking peare, that for the short time that I was abroade I observed more solid matters than any English man did in the like space this long time. For I copied out more inscriptions and epitaphes (said a certain Knight) that are written upon solid peeces of stone, then any judicious traveller would have done in many yeares. For which cause he branded me with the note of tombe-stone traveller. Whereas it had been much more laudable (said he) to have observed the government of common-weales, and affaires of state. I answere him, that because I am a private man and no statist, matters of policie are impertinent to me.[10]

These remarks are of especial interest when set against the creeds of other travellers, and particularly against that of Sandys, because while they include many of the conventional attitudes, the sense of the man's own personal delight in travel is allowed to dominate them, and the way in which this sense pervades the whole of his work gives to it a flavor which most other accounts either lack or possess to a lesser degree.

That George Sandys should have set out on a long journey and that he should have published an account of his travels needs no explanation. His position in society made that a perfectly natural thing to do. As a son of the Archbishop of York he was given the traditional education of the upper class young man of his day; he studied at Oxford and a few years later set out to complete his education by travel. Although one of a number of sons, the one brother with whom he seemed to share the most interests was Edwin, the eldest, who had begun to distinguish himself at an early age. Just as George later followed Edwin's example by devoting some of the best years of his life to the work of administration in the new colony of Virginia, so in this earlier period he was probably influenced by the fact that Edwin had spent some years on the continent. There Edwin had specialized in a study of the state of religion in the principal countries. This study resulted in a book written under the title of *Europa Speculum,* dated April 1559, Paris, but not published until 1605 when it appeared without his consent as *A Relation of the State of Religion.* While not a travel book, the work was not

[10] Coryat, *op. cit.*, I, 11.

without comment on social conditions in the countries in which he spent some time.

George Sandys left England in 1610. He dated the beginning of his journey by mentioning the fact that he travelled through France just at the time of the murder of Henry the Fourth. It is significant that he did not commence his journal until after he had left Venice, for "France I forbear to speak of, and the less remote parts of Italy, daily surveyed and exactly related."[11] He obviously felt that his duty to the state demanded that he penetrate into less often frequented lands that he might return with fresh information for his sovereign.

This book, as well as all his later works, was dedicated to Charles I, then Prince of Wales. Because this dedication indicates so clearly the attitude that Sandys took toward the obligations of the traveller to his government and because he at no other time made a direct reference to this responsibility, it is worth quoting at length:

> The Eminence of the degree wherin God and Nature hath placed you, doth allure the eyes; and the hopefulness of your Virtues, win the love of all men. For virtue being in a private person an exemplary ornament; advanceth it self in a Prince to a publick blessing. And, as the Sun to the world, so bringeth it both light and life to a Kingdom; a light of direction by glorious example, and a life of joy through a gracious Government. From the just and serious consideration whereof, there springeth in minds not brutish, a thankful correspondence of affection and duty; still pressing to express themselves in endeavours of service. Which also hath caused me (most noble Prince) not furnished by better means, to offer in humble zeal to your Princely view these my doubled Travels; once with some toil and danger performed, and now recorded with sincerity and diligence. The parts I speak of are the most renowned Countries and Kingdoms: once the seats of most glorious and triumphant Empires; the Theatres of valour and heroical actions; the soils enriched with all earthly felicities; the places where Nature hath produced her wonderful works; where Arts and Sciences have been invented and perfected; where wisdom, virtue, policy, and civility have been planted, have flourished: and lastly where God himself did place his own Commonwealth, gave Laws and Oracles, inspired his Prophets, sent Angels to converse with men; above all, where the Son of God descended to become man. . . Which Countries . . . are now through vice and ingratitude, become the most deplored spectacles of extreme misery; the wild beasts of mankind having broken in upon them, and rooted out all civility, and the pride of a stern and barbarous Tyrant possessing the Thrones of ancient and just Dominions. Who aiming only at the height of greatness and sensuality, hath in tract of time reduced so

[11] George Sandys, *A Relation of a Journey begun An. Dom. 1610,* (London, 1670), p. 1.

greatly and goodly a part of the world, to that lamentable distress and servitude, under which (to the astonishment of the understanding beholders) it now faints and groaneth. . . . I have not only related what I saw of their present condition, but so far as conveniency might permit, presented a brief view of their former estates, and first antiquities of those peoples and countries: thence to draw a right image of the frailty of man, the mutability of whatsoever is worldly; and assurance that as there is nothing unchangeable saving God, so nothing stable but his Grace and Protection. Accept, great Prince, these weak endeavours of a strong desire: which shall be always devoted to your Highness all acceptable service, and ever rejoice in your prosperity and happiness.[12]

This was the great age of dedications and panegyric verses. Absolute sincerity and candor was not always their most essential quality. The patron usually possessed the sum total of all virtues, and the humble author through excessive understatement was apt to make himself out as quite a fellow. Every page of Sandys' *Relation,* however, is an evidence that he did record "with sincerity and diligence," and that his one great concern was the enlightenment of his fellow countrymen. Thus Sandys presents the perfect example of the type of traveller who undertook his journey with an almost entirely educational purpose in mind, the type "who showed in his character an inclination toward puritanism, and in his work a tendency toward specialization."[13]

In starting out for Constantinople, Sandys followed the favorite route of tourists of the time, that of going first to Venice, and then of making the remainder of the journey by sea. To accomplish this he was forced to make the voyage in stages. His first ship took him as far as Zante where it was quite customary to pick up another boat for eastern waters; his second carried him as far as Sio, the classical Chios, an island of the Aegean; and a third completed the journey.

Although it would have been possible to make the trip from Zante to Constantinople by land across Greece, a route which might be expected to appeal to the Renaissance traveller, almost no one went that way. It must be granted that the way itself was made difficult; Thomas Dallam, who crossed with seven others, reported that they were stalked part of the journey by natives who tried to arrange with their guides to cut their

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[12] Sandys, *op. cit.*, Preface, n.p.

[13] Lewis Einstein, *The Italian Renaissance in England,* (New York, 1902), p. 120.

throats. However, it would seem, that the state of Greece at the moment had little to offer the traveller and that his interest in antiquity did not carry him toward Greek relics. It will be remembered, with respect to English travellers in Italy, that those who went about the middle of the sixteenth century were zealous in their pursuit of remains of the ancient world. In the records of both Sir Thomas Hoby[14] and of William Thomas.[15] This is apparent at every step. Thomas, in particular, while moralizing on the decadence of the once great city of Rome, described in detail the Roman antiquities. As the century went on this interest in antiquity began to decline, an interest in contemporary Italy replacing it in the minds of travelling Englishmen. The fervor of the first antiquarians did not carry them as far as Greece, and by the time travellers began to report on their journeys into the east there had been a shift of interest which left Greece with little to attract the tourist.

For this reason Sandys' account of his voyage through the waters skirting Greece is immediately striking; it differs markedly in tone from the records of other travellers following the same path. The others, practically to a man, drag up the ghost of Leander as they pass between Sestos and Abydos. They view the site of the city of Troy, stirred by genuine emotions, but for most of them it is the city of Virgil rather than the Troy of Homer from which they draw their associations. William Lithgow, who crossed Greece on land in 1609, was inspired by the villages of Argo and Micene "from the which unhappy Helen was ravished"[16] to compose an original poem filled not with the memory of Helen but with moral indignation against the Helens of all times. Beyond examples of this sort, few references to the classical past of Greece are to be found in these works. Sandys, on the other hand, moved slowly through these scenes steeping himself in literary associations, calling not only on Virgil, but on Ovid, Lucretius, Menander, and most of all on Homer for allusions to the places he was passing.

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[14] Sir Thomas Hoby, *The Travels and Life of Sir Thomas Hoby. Written by Himself, 1547-1564.* Ed. by Edgar Powell for Camden Society, Third Series, IV. (London, 1902).

[15] William Thomas, *The Works of William Thomas, Clerk of the Privy Council in the Year 1549*, I, 22.

[16] William Lithgow, *The Rare Adventures and Painful Peregrinations of long Nineteen Yeares Travayles from Scotland to the most famous Kingdomes in Europe, Asia and Affrica*, (1632), (Glasgow, 1906), 63.

Rich as these paragraphs are in their references to antiquity, the flavor of the guide-book still dominates them, chiefly in the precision with which the material is ordered:

We sailed close by Cephalenia, retaining that ancient name of Cephalus, the son of Deioneus; who banished Athens for the unfortunate slaughter of Procris, repaid to Thebes, and accompanying Amphitryo in his wars, made his abode in this island; which was called formerly Teleboas and Melena. It is triangular in form, and 160 miles in circumference: the Mountaines intermixed with profitable Vallies, and the Woods with Champain. Unwatered with Rivers; and poor in Fountains, but abounding with Wheat, Honey, Currans, Manna, Cheese, Wool, Turkies, excellent Oyl, Incomparable (though not lasting) Muscadines, and Powder for the dying of Scarlet. This grows like a blister of the leaf of the holy Oak, a little shrub, yet producing acorns, being gathered, they rub out of it a certain red dust, that converteth after a while into worms, which they kill with wine, when they begin to quicken. Among her many harbours, Argostoli is the principal, capacious enough for a navy. The inhabitants of this island are Grecians, and Venetians their Sovereigns.[17]

Seldom satisfied with merely passing by memorable spots he often took special pains to get the actual feel of famous soil under his feet:

Now against Cape Janizary (desirous to see those celebrated fields where once stood Ilium the glory of Asia that hath afforded to rarest wits so plentiful an argument) with much importunity and promise of reward) it being a matter of danger) I got them to set me ashore. When accompanied with two or three of them, we ascended the not high Promontory, level above, and crowned with a ruinous City, whose imperfect walls do show to the Sea their antiquity. . . . This is that famous Promontory of Sigeum honoured with the sepulchre of Achilles, which Alexander (visiting it in his Asian expedition) covered with flowers and ran naked about it, as then the custom was in Funerals.[18]

In its general form Sandys' account of Constantinople follows the usual formula of the traveller's "relation." An engraving of the city supplied with a key indicating its chief topographical features and principal buildings is first presented. The history of the city is briefly sketched. Its general plan is described, and its most noteworthy buildings are named, with attention centered on the Mosque of Sancta Sophia and the seraglio of the sultan. In common with other travellers of the time his first

[17] Sandys, *op. cit.*, p. 4.
[18] *Ibid.*, p. 15.

impression of the city suffered a severe reversal once he found himself in its midst:

> I think there is not in the world an object that promiseth so much afar off to the beholders, and entred so deceiveth the expectation; the best of their private buildings, inferior to the most contemptible sort of ours. For the Turks are nothing curious of their houses: not only for that their possessions are not hereditary, but esteeming it egregious folly to erect such sumptuous habitations, as if to live forever, forgetful of their graves, and human vicissitude.[19]

The history of the Turks is sketched, and some account of the present Turkish government and policy is given with an Englishman's emphasis upon its tyrannical nature.

The two subjects with which Sandys' discussion of Turkey is most concerned are the military forces and the Mohammedan religion. It is obvious from the scrupulous care with which the organization of the army is analysed that it was with Turkey as a military power that western Europe was most impressed and that Sandys was here fulfilling one of his most important duties to his Prince and country in making a detailed report of that military system. Although in no way sympathetic with Mohammedanism, his account of the religion is much more objective and exhaustive than that to be found in the reports of most travellers.

Several pages are devoted to the Turkish character, to manners and customs, in which are described the people's appearance, their clothing, foods, marriage ceremonies, position of women, and funeral rites. In comparing Sandys' handling of material of this kind with that of his contemporaries, one feels that he comes much closer approximating the approach of the modern historian or sociologist than did most. He was less concerned with arriving at easy and striking generalizations; he reported with the eye of a careful observer who ranged widely in his search for the salient features that could be fitted together to form a whole and consistent pattern of a nation's culture.

He found the Turks "generally well complectioned, of good statures, and full bodies."[20] He was most impressed with their cleanliness and their slothfulness, " a lazy people that work but by fits, and more esteem of their ease, than their profit, yet are

[19] Sandys, *op. cit.*, p. 27.
[20] *Ibid.*, p. 49.

they excessive covetous. And although they have not the wit to deceive (for they are gross-headed) yet have they the will, breaking all compacts with the Christians that they find discommodious."[21] As did other English travellers, he commented on the fact that the Turk's religion did not permit the drinking of wine. He did not take kindly to "Coffa" which he found them sipping most of the day, and was shocked by the prevalence of opium taking. In the arts and sciences he found that they had some knowledge of philosophy, physics, and astronomy. Their poetry and painting pleased him, but he had no liking for their music. He discovered that they studied neither rhetoric nor logic and that they had little taste for reading which he believed they rejected on the grounds that learning might "subvert their false grounded religion and policy, which is better preserved by an ignorant obedience."[22] Unlike Moryson, who, without explaining his grounds for comparison between the past and the present, found signs of demoralization in Turkey, in the less warlike nature of the emperors, in signs of internal rebellion in the army, in a decrease in religion, and in increase in extortion and suppression, Sandys did not imply such a state of affairs although his picture of the then reigning monarch, Sultan Achmet, was not one that would lead his readers to expect any great things to be accomplished under such a weakling.

Book II of the volume deals with Sandys' travels in Egypt, his next objective after leaving Turkey. Although his method of handling the material is essentially the same as that of the first book, the emphasis is inevitably different. The Egypt of the moment offered little to interest him except what served as a means of contrast with the past. For him "Alexandria hath nothing left her but her ruines, and those ill witnesses of her perished beauties, declaring rather that Towns as well as men, have their ages and their destinies."[23] The phenomenon of the Nile was, of course, a source of wonder to him. The strange animals of the country, the crocodile, the ichneumon, and the chameleon, he found worth describing. Of the habits of the latter he repeated a theory that must long have had currency

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[21] Sandys, *op. cit.*, p. 57.
[22] *Ibid.*, p. 58.
[23] *Ibid.*, p. 89.

inasmuch as it had been seriously reported by Leo Africanus when he visited the country a century before:

> Camelions are said to bear a deadly hatred to the Serpent: insomuch as when they espy them basking in the Sun, or in the shade, they will climb to the overhanging branches, and let down from their months a thread, like to that of a Spinster, having at the end a little round drop that shineth like Quick-silver, that falling on their heads doth destroy them: and what is more to be admired, if the boughs hang not so over, that the thread may perpendicularly descend, with their former feet they will so direct it, that it shall fall directly.[24]

Sandys was also impressed by the method of incubating eggs in warm ovens which the Egyptians had invented. But for the most part, it was the Egypt with a history stretching back into the dim reaches of the past that caught his imagination, the Egypt of an ancient religion, the Egypt that "first invented Arithmetick, Music, and Geometry: and by reason of the perpetual serenity of the air, found out the course of the Sun and the Stars,"[25] the Egypt of the Pyramids, the Sphinx, and of mummies marvelously preserved.

Sandys made his way from Cairo to Jerusalem by carvavan, bribing guides along the route to insure protection against the Arabian marauders who were a constant menace to pilgrims. After getting lost in the mountains and suffering other hardships, the party reached the gates of the city where they were met by two Franciscan friars who conducted them to the Roman Catholic monastery of San Salvatore, "for all that come must repair to their Convent, otherwise they shall be accused for spies, and suffer much trouble."[26] Inasmuch as none of the Protestant rulers of Europe contributed to the upkeep of any foundation in Jerusalem, all western Europeans were consequently classed together, and the convent gave shelter to Protestant and Catholic alike. Sandys and his three companions, at the end of their eight day stay, paid the monastery about one hundred dollars for its hospitality only to be told that that had scarcely paid for their food. He considered this a costly rate for a monastic diet, but he preferred it to the extortion he would have suffered at the hands of Turkish hosts.

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[24] Sandys, *op. cit.*, p. 95.
[25] *Ibid.*, p. 81.
[26] *Ibid.*, p. 124.

Before beginning his account of the city of Jerusalem, he seemed to feel that some apology to his readers was necessary:

> Although divers both upon inquisition and view, have with much labour related the site and state of this City, with the places adjoyning, (though not to my knowledge in our language) insomuch as I may seem to some, but to write what hath been written already: yet notwithstanding, as well to continue the course of this discourse, as to deliver the reader from many erring reports of the too credulous devote, and too too vain glorious, I will declare what I have observed, unswayed with either of their vices.[27]

It would seem that Sandys took some pains to arrive at Jerusalem just in time for the Easter ceremonies. Two events, in particular, attracted vast numbers of pilgrims at this season. The first was the only excursion of the year to the River Jordan; the second, the descent of the Holy Fire from heaven into the Church of the Holy Sepulchre. It is interesting to compare the accounts of the various celebrations as seen through the eyes of Sandys, Lithgow, Coryat, and Pietro Della Valle, an Italian, who were in Jerusalem at Easter in the years 1611, 1612, 1614, and 1616, respectively.

Sandy followed the usual pilgrim custom of going to the Temple of Christ's Sepulchre on Maundy Thursday and of spending the next three nights lying on its cold stones. There he found himself in the midst of a strange assemblage, gathered from many nations, speaking different languages, each racial group engaged in its own rituals accompanied by dancing, leaping, wailing, singing to strange instruments, and other forms of religious excitement. He took a much more moderate tone in describing these performances than did Lithgow, who branded most of the rites as "sinfull, odious, and damnable idolatry."[28] Sandys' picture of the descent of the Holy Fire, which to the European was no more than an object of interest, Catholic and Protestant alike disbelieving its actuality as openly as the Turk, catches the bizarre flavor of the whole scene and gives an indication of his own attitude:

> But the Greeks do here surpass all the rest in multitudes; and the Armenians in bravery, who instead of Musical Instruments, have Sawcers of Brass (which they strike against one another) set about with gingles. All differ in habit, and most in rites; yet all conjoin (the Latines excepted) in celebration of the impostury of fetching fire from the Sepulchre on

[27] Sandys, *op. cit.*, *p.* 120.
[28] Lithgow, *op. cit.*, p. 241.

Easter-Eve. The Turks deride, yet throng to behold it, the Galleries of the round Temple being pestered with spectators. All the Lamps within the Church are at that time extinguished; when they often compassing the Sepulchre in a joint procession, are fore-run and followed by the people with savage clamors (the women whistling) and frantick behaviours, befitting better the solemnities of Bacchus, extending their bare arms with unlighted tapers. At length the chief bishops approach the door of the Sepulchre, but the Aethiopian Priest first enters (without whom they say the miracle will not fadge) who after a long stay (meanwhile the people hurrying about like mad men) returns with the sacred flame, supposed at his prayers to burst out of the Sepulchre; whereat confusedly they fire their lights, and snatching them from one another, strive who should convey it to their particular Chapels, thrusting the flame amongst their cloaths, and into their bosoms, (but withdrawing it) perswading strangers that it will not burn them: kindling therewith all their lamps, unlighted with other fire until that day twelve-month.[29]

Although he visited with avid interest the principal sacred spots of Jerusalem, made the Easter-Monday journey on an ass to Emmaus to see the place where Jesus had broken bread with Cleophas and the mountain from which Joshua had commanded the sun and moon to stand still, went to Bethlehem where he described the place of Christ's nativity with the same exacting detail he had used in describing Christ's Sepulchre and the Sepulchre of the Holy Virgin, and sought out most of the other spots of religious significance in the Holy Land, his whole account is so objective and concrete that one sees him most of the time in the role of the detached and intelligent tourist and only very briefly as anything approaching the devout pilgrim. Once upon entering the Temple of Christ's Sepulchre he broke out, "Oh, who can without sorrow, without indignation, behold the enemies of Christ to be the Lords of his Sepulchre! who at festival times sit mounted under a Canopy, to gather money of such as do enter."[30] And again before a picture of the Resurrection:

Here thousands of Christians perform their vows, and offer their tears yearly, with all the expressions of sorrow, humility, affection and penitence. It is a frozen zeal that will not be warmed by the sight thereof. And, Oh that I could retain the effects that it wrought, with an unfainting perseverance! who then did dedicate this hymn to my redeemer.

Savior of mankind, Man, Emanuel;
Who sinless died for sin, who vanquished Hell:

[29] Sandys, *op. cit.*, p. 134.
[30] *Ibid.*, p. 125.

> The first-fruits of the Grave; whose life did give
> Light to our darkness; in whose death we live;
> O strengthen thou my faith, correct my will,
> That mine may thine obey; protect me still,
> So that the latter death may not devour
> My soul seal'd with thy seal. So in the hour
> When thou, whose body sanctified this Tomb,
> Unjustly judged, a glorious Judge shalt come
> To judge the world with justice; by that sign
> I may be known, and entertain'd for thine.[31]

So few are the original poems of Sandys that it is especially gratifying to come upon this fervent prayer which, while probably not his first poem, must stand for us as his first.

In the last book of the volume, Sandys has turned his face toward England; this is his account of his voyage through the Mediterranean. He touched on various islands along the way, made a considerable stay at Naples, and finally reached Venice, where, as it had started, the journal ends. Again, as in the opening book, this part is full of the atmosphere of a literary pilgrimage. The pages are strongly scored with quotations from Homer, Ovid, Virgil, and other poets of antiquity. This is to the modern reader the least interesting of any part of the volume because it is so little more than a classical handbook to the islands of Cyprus, Crete, Malta, and Sicily.

His description of Naples does offer an opportunity for comparisons with the observations of his compatriots. Both Moryson and Lithgow visited Naples within a few years of the date of Sandys. In reading the accounts of these three men and noting some of their marked similarities, one becomes convinced that Italian cities must have become very much aware of tourists and that, as in the case of modern cities, they saw to it that certain stock attractions were insistently called to the attention of every traveller before he left for other parts. Vesuvius, the sepulchre of Virgil, the Court of Vulcan, the amphitheatre, the villa of Cicero, the Grot of the Cumean Sibyl, the Lake of Agnano, the Lake Avernus, and the Cave of the Dog were visited in almost regular order by these three men and commented on in much the same terms. All three tried the traditional test at the Cave of the Dog, that of thrusting a dog, always thoughtfully provided by a native, into the vaporous mouth of the cave. When

[31] Sandys, *op. cit.*, p. 130.

the dog was dragged out seemingly dead, he was then tossed into the nearby waters of the Lake of Agnano where he was supposed to revive. For both Sandys and Moryson the experiment worked according to rule and the dogs recovered. Lithgow, however, was unwilling to pay the exorbitant price the owner of the dog wanted to charge; so he entered the cave himself in spite of the many legends of fatalities that surrounded it, and stayed there until he nearly suffocated. As soon as he had taken some wine to restore himself, the dog owner accused him of being the devil but offered to put the dog through his paces for a much smaller sum than he had indicated at first. When the dog was pulled out, he was dead; even the waters of the lake could not resuscitate him. The owner was so grief stricken to have his source of livelihood removed that the tourists paid him a double fee before leaving the scene.

As has been indicated before, what is probably the most distinctive feature of the *Relation* is the profusion of classical quotations scattered through its pages which give to the work a more authentic literary coloring than any of the other travel books of the period possess. Not only Virgil, Homer, and Ovid, either his favorites or the most logical sources for place and character allusions in the eastern waters of the Mediterranean, but also Lucan, Horace, Martial, Juvenal, Lucretius, Cicero, and many of the less familiar writers, such as Propertius, Sidonius, and Statius are quoted. Anthony Wood was probably resorting to conjecture when he described the actual process of the writing of the book by saying that Sandys returned to England "where digesting his notes and interlarding them with various parts of Poetry, according to the fashion of the time, published them in English."[32]

Lavish as the Elizabethans and their successors were with quotations in most types of their prose, quoting was not a habit that had been taken over very widely by travel books. Coryat prefixed his chapters with Latin lines from Scaliger describing the cities with which he was about to deal; Moryson seldom went beyond inserting Latin epitaphs that had caught his fancy; Lithgow sometimes introduced a Latin quotation, but he was more apt to offer original verses of his own written in very clumsy couplets.

[32] Anthony Wood, *Athenae Oxonienses*, (2nd. ed., London, 1721), II, 46.

That Sandys should have made such frequent use of quotations is the more noteworthy because he otherwise so closely followed the conventional pattern of the travel journal. Nor does one feel justified in accusing him, as one can many of the prose writers of the time, of introducing quotations as little more than a means of parading learning, for those of Sandys are too deeply woven into the text. His first concern was to bring home with him an honest picture of the peoples and the lands he visited as they were at the time, but he was also deeply aware of the mark that the past had left on these peoples and places. For himself and for his fellow Englishmen he must have felt that that glorious past could only be linked with the present by steeping oneself in the great writings that had come out of those other times. He was in no sense romantically attempting to identify himself with antiquity; his purpose was educational. The very fact that he found justification for printing his quotations in two forms, in parallel columns, first in the Latin, then in his own translations, shows how anxious he was to make that union of the past and the present as easy as possible for his readers.[33]

What Sandys gained in the dignity and even tone of his work, in the distinct charm of his prose, in his strict adherence to an impersonal and objective point of view in the handling of his material, he often lost in the absence of the more genial qualities which some of the other travel writers displayed and which gives a variety to their writing that his lacks. So little of the man himself emerges; one feels the pity of this as soon as one discovers the scantiness of biographical material dealing with his personality. On not more than two or three occasions in the whole book does he allow anything approaching a personal anecdote to appear. Travelling was far from an easy matter in those days; yet, aside from storms at sea, little ever seemed to interfere seriously with his movements. Moryson, on the other hand, seldom stirred without some sort of an adventure. It was his delight to court danger and to devise elaborate means of escape. He managed to see the inside of a Spanish fort by dis-

[33] The quotations range in length from a single line to a dozen or more. With only a few exceptions, such as those from the Odes of Horace which are done in four-foot lines, the translations are in the form of decasyllabic couplets, the form he was later to use in his own translation of the *Metamorphoses* of Ovid. One notes that the Homeric quotations appear alongside a Latin rather than a Greek text.

guising himself as a German;[34] as a Frenchman he got inside the Jesuit college at Rome;[35] he made his way through a band of German robbers by dressing as a poor Bohemian, without cloak or sword.[36] On another occasion he was robbed by French soldiers of even his inner doublet in which he had quilted his money, but even this did not leave him penniless as he had concealed some gold crowns in a box of "stinking ointment" which the soldiers threw down in disgust.[37] Lithgow seemed always to be having trouble with his papers, and finally suffered the most excessive tortures at the hands of the Spanish Inquisition, the account of which forms one of the most thrilling records in all travel literature.

One looks in vain in Sandys for signs of personal tastes or eccentricities such as one finds in the amusing observations of Coryat, in Moryson's absorption with money which even caused him to prefix his volume with a chart indicating the rate of exchange in various countries, or in the violent anti-Catholic feeling that so dominated every view of Lithgow and caused him continually to torture his prose by piling epithet on epithet.

But against these criticisms there still stands the thoroughness and soundness of Sandys' account with which the rest can seldom compare. The others are often more sprightly than he, but when they are dull, they are apt to be infinitely more pedestrian than he ever is. His prose is dignified and scholarly, and often nobly rhetorical in style, as is this apostrophe to England:

> Now shape we our course for England. Beloved soil; as in scite,
> —Wholly from all the World disjoined;
> so in thy felicities. The Summer burns thee not, nor the Winter benums thee; defended by the Sea from wastful incursions, and by the valour of thy Sons from hostile invasions. All other Countrys are in some things defective; when thou, a provident Parent, dost minister unto thine whatsoever is useful: foreign additions but only tending to vanity and luxury. Virtue in thee at the least is praised, and Vices are branded with their names, if not pursued with punishments. That Ulysses
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> Who knew many mens manners, and saw many Cities: if as sound in judgment as ripe in experience, will confess thee to be the Land that floweth with Milk and Honey.[39]

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[34] Moryson, *op. cit.*, III, 411.
[35] *Ibid.*, I, 304.
[36] *Ibid.*, I, 78-80.
[37] *Ibid.*, I, 309.
[39] Sandys, *op. cit.*, p. 170.

His sentences are sometimes, as are those of most of the contemporary prose writers, lengthy, cumbersome, and obscure through too great compression. But against these may be set any number of strikingly clear and pointed pieces of description or comment, as when he says of the Arabs, "They dwell in tents, which they remove like walking cities, for opportunity of prey and benefit of pasture," or his picture of the people of an Aegean isle, "a happy people that live according to nature and want not much in that they covet but little."

Sandys' finest prose writing is that which arises from a grave mood of melancholy, a mood very similar to that which gives to the greatest pages of Raleigh their sombre majesty. In such passages Sandys achieves rhythms and harmonies not unlike those of Raleigh. Much that he saw awakened such feeling in him, the pyramids, Alexandria with its ghostly sense of a brilliant past, the Holy Sepulchre in the hands of the pagans; but this emotion is probably given its finest expression in that part of the dedication to the Prince in which he sums up in moving periods that sense of perpetual change, "of the frailty of man, the mutability of whatsoever is worldly," which so often turns his mind from the transient glories of this world to the assurance that "there is nothing unchangeable saving God."

THE RISE OF PROFESSIONALISM IN SWITZERLAND ABOUT 1700

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FOREWORD

Sometime ago there were turned over to the writer two High-Alemannic parchment manuscripts which had been a family possession for six generations. The first, entitled "Lehrbrieff," is a letter of release granted in 1677 by the Association of Master Surgeons of Bern, certifying the completion in Thun by an Isaac von Grüeningen of Saanen of an apprenticeship in surgery; the second, entitled "Attestation," is a testimonial issued by the mayor of Thun, Niclaus von Diessbach, who in his capacity as chief magistrate discloses the description and outcome of twenty-two surgical cases within his jurisdiction and under the care of the *Oculiss, Bein- Bruch- Schnitt- und Wundartzt,* Ysaac Von Grunigen (evidently a variant spelling of the name in the "Lehrbrieff"), resident at Interlaken in 1695.

The question of the possible philological and medico-historical significance of these instruments led to a critical study of their texts and to the present attempt to place them in historical perspective. It may be said at the outset that linguistically they document a number of interesting examples of the comparatively late preservation in the Canton of Bern of different MHG. and EG. (see p. 298) language characteristics as well as the extent of the influence, as late as the close of the seventeenth century, and as far west as Bern, of the syntactical style and legalistic phraseology of the German imperial chanceries. The substance itself is of sufficient cultural and medico-historical interest to warrant its wider availability; therefore, the writer has prepared an English translation of the texts and a glossary of words now obsolete or peculiar to the High-Alemannic dialect of this period.

With respect to the authenticity and ownership of the documents, it may be said that there is an Isaac von Grüningen identified in the parish records of Saanen, Canton Bern, in 1696 as

Bruch Schneit and again in 1697 as *Bruchartzet.*[1] He is evidently the "surviving, legitimate son of the honorable etc. Peter von Grüeningen" of the "Lehrbrieff" and the *Oculiss* etc. of the "Attestation." The Saanen baptismal register records on August 22, 1645 the baptism of Isaac, the third son of Peter von Grünigen and Katri Würsten.[2] If this is the apprentice of the "Lehrbrieff," he was not quite 32 years old in 1677 when granted his release and 50 in 1695 when given the "Attestation."[3] A younger son of Peter and Katri is the father of Hanns,[4] the father of Johannes,[5] the father of Jacob,[6] in whose possession the writer's father, who emigrated from Saanen in 1871, and his sister, Elizabeth Plüss-von Grünigen, first knew the manuscripts to be. Upon the death of all other interested parties Mme Plüss inherited the manuscripts and in 1925 presented them to the writer.

The Strife between Medicine and Surgery

The story of the struggle between medicine and surgery constitutes an interesting chapter in European cultural history. In the Bernese highlands, where in certain respects the mists of medievalism lingered longer than elsewhere and where in other respects there was civic progress far in advance of the time, there is afforded toward the close of the seventeenth century a peculiarly significant picture of the development of professionalism in surgery. Owing in part to the comparatively late flourishing of the guilds, organized surgery could maintain and advance its own professional dignity and interests precisely at a time when dogmatism in the universities sorely impeded the advance of medical science and when there was thriving not only in secret corners but in the market places, often under political protection, a superstitious quackery unbelievably brutal and ignorant.

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[1] *Saanen Taufrodel* vol. 7:272 and 284.

[2] *Ibid.* 6:61.

[3] This instrument is thus obviously not a diploma granted upon the completion of a probationary period of practice but a testimonial of "transfer" enabling the surgeon, who moved his place of residence from Interlaken to Saanen, the better to establish himself in his new location.

[4] *Saanen Taufrodel* 7:160.

[5] *Ibid.* 8:237.

[6] *Ibid.* 10:192.

The Rise and Decline of Science

The decline of the spirit of academic freedom in medicine is vividly portrayed by Brunner and Muralt.[7] Leading professors of medicine were teaching about 1700 a mixture of mathematical mysticism and hocus-pocus in the name of medical science that Paracelsus of the sixteenth and the scientists of the early and middle seventeenth century would have been ashamed of. Even in the university of Basel, where surgical instruction had experienced a promising beginning under Caspar Bauhin in the last quarter of the sixteenth century, there was a sorry decadence toward the end of the seventeenth. The unprecedented rise of science in the late sixteenth and early seventeenth centuries would seem to augur anything rather than a set-back of scholarly achievement for almost two centuries. The study of medicine begun by the Greeks had been quite forgotten in the middle ages. With the rediscovery of Hippocrates a revitalizing influence came to be exerted in the West. Paracelsus (d. 1541), remembered for his advancing the study of chemistry, had fearlessly thundered against the abuses of faith healing and had contributed toward a more scientific approach to medicine. Galileo (d. 1642), Kepler (d. 1630), Torricelle (d. 1647), Gùercke (d. 1686), Boyle (d. 1691), and Newton (d. 1727) had vastly extended scientific knowledge in astronomy, physics, and mathematics. Bacon (d. 1626), Descartes (d. 1650), and Spinoza (d. 1627), had liberalized the mind in philosophy. Tournefort (d. 1707) had discovered the new principle in botany of plant analysis based on the blossom—an incalculable advance over the method of classification according to months of growth; Harvey (d. 1657) had discovered the circulation of the blood and Cowper (d. 1709), the capillary system, while Malphigi (d. 1694) had become founder of microscopical anatomy. Furthermore, with the beginning of the seventeenth century there were instituted numerous scientific and medical societies contributive to the advancement of learning. There were founded: in 1603, the *Academia dei Lincei* in Italy; in 1632, the *Academia Caesareo Leopoldina* in Germany, a society of physicians including in its membership the foremost German-speaking scholars of Eur-

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[7] Brunner, C. und Muralt, W. *Aus den Briefen hervorragender Schweizer Ärzte des 17. Jahrhunderts*, Basel. 1919.

ope; in 1645, the *Royal Society of England;* and in 1666, the *French Academy of Sciences.*

It is not our purpose here to investigate the factors responsible for the long period of academic stultification coming with the turn of a cycle upon these promising beginnings. Suffice it to say that perhaps nowhere is there to be found a more telling example of the full sweep of this decline than in the history of the science and practice of medicine. In many instances every further progress had to await the coming of the nineteenth and twentieth centuries. Thus the beginning of instruction in hospitalization under Felix Platers I in Basel came to an end in 1677 (the date of our older manuscript) and it was not until the middle of the nineteenth century that serious attention was directed, for example, to the worthy surgical care of wounded soldiers. Again, the discovery by Leeuwenhoek, made in 1671 with the aid of a microscope, of foreign animal life in boils led only to the idea of *contagium animatum,* and almost two centuries had to elapse before the discovery of bacteria. As early as 1667 Jean Denis successfully carried out transfusions of blood and experiments by means of injecting medicants into the blood stream, but the immediately following century was at an utter loss in taking the succeeding step leading to serum therapy.

There arose in the seventeenth century three leading schools or movements in medicine. The theoretically schooled physician received little practical experience while in training. In his capacity as healer he would find the lines of least resistance in adhering to one of the contemporary schools, a circumstance that precluded methodical investigations of independence. The first of these schools, the iatrochemical, based in part on Paracelsus and in part on chemistry and philosophy, had received impetus from Holland through Franz de la Boë of Leyden (d. 1672). All sickness was believed to have its origin in the mixture of juices, in fermentation, or chemical action. The function of the doctor was to prescribe the proper medicants for counteraction. The principal occupation of practicing physicians came to be that of making trial-and-error experiments with all manner of mixtures. A second school, the Hippocratic, forerunners of which had been Santoro (d. 1636) and Borelli (d. 1679), the latter called the founder of physiology, was based chiefly on physics. Disease, it was held, is of a mechanical nature. By carefully weighing, measuring and counting whatever can be

weighed, measured and counted, one can discover what needs to be corrected. The procedure accurately applied did indeed yield some very substantial gains in the advancement of knowledge, for example, in connection with the study of the muscles, the mechanics of breathing, and physical optics, but on the whole the school gave rise to a pseudo-scholarship that floundered in its nonsensical attempts at applying higher mathematics, calculus and logarithms, hydraulics, centrifugal and centripetal forces in reading the deeper secrets of healing. The third school, called the empirical, grew out of the theory of objective observation of the course of diseases as advocated and taught by Sydenham (d. 1689). The school added materially to the exact knowledge of diseases. Sydenham's recording of the symptoms and the course of hysteria, St. Vitus dance, gout, pleurisy, pneumonia, erysipelas, and croup are still recognized as being masterfully done. Toward the end of the century this school, too, led to dogmatism. The panacea of the empiricists was "regularity." Their medical theory is reflected in their favorite aphorism to the effect that a good clown is more conducive to the public health of a town than twenty asses laden with drugs.

Fischer[8] and Heinemann[9] describe the typical physician about 1750. In that he was more than half a century in the making, he may serve to throw light on the physician about 1700. With all the airs of academic arrogance he strides through the streets in stately dignity, wearing a powdered peruke, jabot, scarlet velvet breeches, a long robe, frills of lace at his wrists (the scorn of all practical surgeons), carrying a heavy cane used as a chin rest when diagnosing particularly perplexing cases. To him fell the city, court, and university appointments and the fat support of the patricians, so that he could well afford to ignore the guild of surgeons that had come up by way of the barber shop.

The Early History of Surgery

Surgery may be said to have had two lines of ancestry, both dating from the eleventh century. When it was decreed in Rouen in 1092 that monks were not to wear beards, there came into being a new servant of the church in the capacity of barber. In

[8] Fischer, Georg *Chirurgie vor 100 Jahren* Hannover, 1876.

[9] Heinemann, Franz *Die Zunft der Barbiere und Schärer, genannt "Chirurgische Societät" der Stadt und alten Landschaft Bern vom 16.-19. Jahrundert.* Neues Berner Taschenbuch auf das Jahr 1900, pp. 76-98.

the course of time he acquired certain concessions entitling him to train apprentices, to practice blood-letting, to bandage wounds, and to perform minor surgical operations. But the story of barber-surgery is not one of steady advance. In fact the shop and the business of the barber soon fell into evil repute, evoking the wrath of the church and the fury of the trade guilds. The church, which had first given rise to the barber-surgeon and which had developed its own hospitals and asylums in the early middle ages, vigorously opposed surgery in principle, denying the right of priesthood to anyone who had been operated upon. As to trade guilds—there are evidences up to the fifteenth century that some of these organizations required of their members an oath to the effect that they were not "bastards, barbers, bath-keepers, nor Wends." The other ancestor of the surgeon is the medieval bath-keeper. He and his hospital first appeared to combat leprosy carried to Europe by the returning eleventh-century crusaders. The obliging bather soon learned to operate with clysters and plasters and began competing with the barber in the treatment of open sores and wounds, and in blood-letting. The bitter struggles between barbers and bath-keepers were anything but salutary for the elevation of surgery to a reputable profession. At the Congress of Augsburg in 1548, however, barber-surgeons were granted guild privileges. Once organized they steadily managed to get the greater part of chirurgery into their hands. In 1682 by official recognition of Emperor Leopold I, surgery throughout the empire was classed as an art not as a trade. Mutual consultations between doctors and surgeons were encouraged by the guilds and the city councils, but the gap between the dogmatically trained physician and the guild-born surgeon was usually too wide to be bridged. To make matters worse for the surgeon there was the serious competition of itinerant and market-crying quacks, among them the hangman, who was presumably in possession of a store of healing secrets confessed by witches,— and witches were executed in Geneva as late as 1652, and in Glarus as late as 1787. Thus between two evils—one, as it were, from above and the other from below—professional surgery in Switzerland in the seventeenth century, bent on vindicating itself, actually paved the way to a new ascendancy, thanks, in part, to the imperial recognition the profession enjoyed; in part, to the dignity, vitality, and political alertness of the guild; and in part, certainly, to that unmistak-

able socio-civic consciousness characteristic of Swiss municipal citizenship. It may be of interest to note in this connection an example from the "Attestation" bearing upon problems unsolved to this day, chief among them the question of the place of the state with respect to the rights and privileges of practioners. The surgeon in this case, desirous of changing his place of residence and practice, requests from the mayor of Thun (who is at the same time a member of the great council of the City of Bern), an official testimonial certifying his accomplished recoveries. The mayor, who is ready to comply with the request "since . . . testimony contributing to the truth should be refused no one but delivered to petitioners for (their) future help," causes the former patients to be questioned and enters their testimony upon a "true legal document . . . secured . . . by my noble seal," granted to the petitioner for his future possession.

The close association between the guild of master-surgeons and the city council of Bern is repeatedly revealed throughout the sixteenth and seventeenth centuries. The history of the progress of the surgical guilds in Switzerland is told by Brunner.[10] A local surgical organization had been effected in Bern as early as 1502, or 46 years prior to the granting of guild privileges by the Congress of Augsburg. There is in 1502 considerable emphasis on "shearing" or barbering. It is vagabond barbers who are to be examined and debarred if found wanting. By 1628 the chief concern of the guild seems to be surgery, for there appeared in that year before the city council a joint committee of city physicians and guild surgeons praying for a new charter enabling them the better to cope with quackery. The new ordinances drawn up called for an apprenticeship of three years and a journeymanship of six years on the part of all candidates desiring to enter the surgical profession. By the end of the seventeenth century barbering had probably come to be regarded beyond the pale of true professional interests of the guild, although it may have been practiced incidentally because of economic necessity. In England by way of comparison the barber-surgeon is in evidence up to 1745.[11] There is no reference, however, to shearing in the "Lehrbrieff," while the imposing title of the surgeon of the "Attestation," may give an

[10] Brunner, Conrad *Die Zunft der Schärer und ihre hervorragenden Vertreter unter den Schweizerischen Wundärzten des XVI Jahrhunderts.* Zürich, 1891.

[11] Garrison, Fielding Hudson *An Introduction to the History of Medicine.* Phil. 1929, p. 294.

intimation of the scope and possibly of the supposed ranking of his different professional activities. He is *Oculiss, Bein- Bruch- Schnitt- und Wundartzt,* that is to say in order of enumeration, (1) a fitter of spectacles—which the seventeenth century was learning to mount on the nose, (2) an amputator, (3) an operator for inguinal rupture, (4) an incisor for harelip and excisor of growths, and (5) a treater of wounds and open sores.

Questions touching the status of apprentices and journeymen and their mutual relations, were constantly arising. Efforts were made to answer these questions in 1649 and again in 1663, when it was decreed that candidates be apprenticed and released only in presence of the entire guild in convention assembled, a practice substantiated in the "Lehrbrieff" of 1677. The candidate from Saanen is documented as having been apprenticed "some time ago in the presence of our entire association of master surgeons in accordance with this profession's custom and usage," and his request for release is granted by the association "while in session as a guild of masters in accordance with local usage."

The character of the powerful association of master surgeons in Bern is reflected in their professional code. No member of the laudable profession is permitted to solicit votes in the guild; patients with a grievance are to be granted a hearing before the guild—the appellate court is the city council; no member is to criticise a colleague in the presence of a patient, but if there is cause, the surgeon is obliged to criticise in private, reporting the circumstances to the guild; no major operation may be undertaken by any member without the presence of an experienced colleague; consultation is to be encouraged, and those asked are to advise freely but not so as to betray to the patient that a mistake has been made; no one is to remove the bandage placed by a colleague nor secretly to view the wound treated by another; no one is to disparage the skill of a colleague, especially not in the presence of apprentices; fraternizing with vagabond quacks is strictly prohibited; robbing money from thoughtless people by tinkering, soothsaying, and kindred frauds are all abominations devoutly to be despised; no member is to absent himself from the funeral of a colleague.

Owing either to the apprenticeship system of training or to the hostility of the academicians, or to both, the chief contribu-

tion of the masters, however, was not so much the furtherance of surgical knowledge and skill as it was the creation of professional spirit. Garrison observes that in comparison with the extensive development of anatomy in the seventeenth century, its literature of surgery seems meagre. This is not surprising if conditions obtaining in Switzerland are at all indicative of conditions elsewhere. To be sure there are genuine contributions by master surgeons, some as early as the sixteenth century, for example, those of Jacob Ruff (*Trostbüchle,* 1554) and Felix Wirz (d. 1563) of Zürich, and Fabricius Hildanus (d. 1624) of Bern. But as a rule the masters did not publish. Some of them no doubt had studied medicine—and indeed surgery—as it was then offered in the universities. In Basel the faculty decreed in 1674 that surgical students be permitted to make practical operations. In Leyden and Strassburg there were lectures on surgery. But these and similar opportunities were after all rare and limited to apprentices of means. A medical student in Paris in 1677 complains that only few are allowed to witness surgical operations and these only upon their sacrificing several gold pieces. Everywhere except in Italy there was also the problem of available cadavers.

That apprentices were permitted, perhaps encouraged, to hear lectures on surgery or to gain practice at the universities or elsewhere in addition to that which the masters could give is reflected in the "'Lehrbrieff." The request for release is prefaced with the statement that the apprentice whose term has been completed "now intends with the help of God to visit also other localities and foreign countries and to strive after further perfection in the free laudable art, to which end an authentic credential and certificate with respect to his learning would be necessary," and is concluded with a recommendation of the candidate to all "Doctores Medicinae, Chirurgos, und operatores." It is quite likely that journeymen who had completed their apprenticeship under the direction of a surgeon should be particularly desirous of gaining experience if possible under the direction of a physician. The final examination for mastership was conducted by a doctor of medicine.[12]

[12] The writer is indebted for this information to Professor R. Feller of the University of Bern, who kindly suggested source material and rendered some aid with the glossary. Professor Feller writes, "Die Meisterschaft in der Zunft der Barbierer und Schärer zu Bern wurde erlangt nach Absolvierung einer vorgeschriebenen Lehrzeit . . . und nach dem vor einem Dr. medicinae abgelegten Examen."

Within the jurisdiction of the guild there came also the regulation of the rights and privileges of "country" over against "city" practioners. The contrast between these two groups about 1700 may not have been vastly dissimilar to the lingering disparity between physicians and surgeons. The security and rewards of the country surgeon were uncertain. He was considered on general principles to be professionally inferior and was relegated to practice in the county, often at a disadvantage and under difficulties. It is in all probability an example of the manner of limiting practice, that there is recorded in the "Attestation," not a single case in the city of Thun, where the surgeon was trained, nor at Interlaken, his legal place of residence. All of the cases mentioned are in the country,—six at Bluhmenstein, five at Thieracheren, three at Kilchdorf, two at Amsoldingen, two at Stocken, one at Langenige, and one at Homberg. The mention of the surgeon's moderate fee, the recording of the gratitude of the patient who paid the notary's bill, and the reference in two instances to the futility and expense of other previously tried remedies disclose not only what came within the then ethical code, but also that the emoluments were probably meagre and now and then had to be taken in kind. The prospect of moving to his home town at the age of 50, may indeed have appeared to the surgeon of 1695 as a promising beginning.

An interesting documentation of the conception of the responsibility of an operator in Thun at this time is found in the formula in the "Attestation," implying that the surgeon's work was not held to be discharged with the completion of the operation. It is said that Frère Jacques, the strolling incisor (who in 1697 introduced lateral operation for stone) would deliver his patients with the words, "The operation has been successful; now may God heal you." The formula in the "Attestation," by way of contrast, reads: ". . . with the help and succour of God did successfully operate and heal . . . and by means of applied attention and requisite medicaments did restore to health."

Of the twenty-two cases recorded, fifteen are operations on males for inguinal rupture, nine are described as congenital; three cases are treatments of open sores; two are amputations, "a femur at the hip," and the removal of both legs of a child, then also there are: one operation for an "abdominal injury," one incision for harelip, and the removal of "a large misgrowth."

The ages of patients, given in fifteen instances, range from seven weeks to 60 years; five are infants less than a year old, five are more than four and less than fifteen, and five are between 20 and 60. Singular is the matter-of-fact report of the healing of a patient "partly in eight days, partly in ten days, etc."

Form and Style

In form and appearance both manuscripts display the pretentious elegance characteristic of the late medieval guilds. The seals are missing but sharp incisions show where they had been fastened. The "Lehrbrieff" measures 36 by 56 cm., the "Attestation," 63 by 74. The text in each case begins with an arabesque capital "W" designed of endlessly curved and crossing lines into a strikingly pompous initial, surmounted upon a background of interlaced ornamentation that defies imitation. The initial letter of the "Attestation" measures 14 by 30 cm., while that of the "Lehrbrieff" is not quite half as large. In both manuscripts the first four lines are of different sizes of lettering, gradually diminishing in succeeding lines to that of the writing proper beginning in the fifth line and done apparently by the less skilled hands of ordinary notaries, who evidently procured from special penmen the perhaps standard opening lines done in magnificent form. The beauty of some of the lettering is unsurpassed. The German handwriting throughout is easily legible and in general consistent though rich in variations and flourishes. Latin formulas, *Actum ut supra, Doctores Medicinae,* etc., and words of Latin or Greek origin, *admittirt, Attestation, Chirurgos, Notarium, patienten, Recommendation,* etc., are done in script. However, when there are German prefixes or suffixes the German elements are scrupulously done in German writing. Thus beside *Cur* we have ze*cur*ieren and *cur*iert; furthermore *accident*en, *Medicament*en, and *Operat*oren—over against *operatores* in the "Lehrbrieff." The word Liberey (see Glossary) which is entirely in German writing was evidently felt to be thoroughly Germanized.

In spelling (see ¶ 9 under "Spelling Practices" p. 297), especially in the practice of compounding, there is considerable uncertainty of feeling. Thus the word *Mutterleib* (so spelled only once) has four different spellings. It appears also as two words,

Mutter Leib, as a solid word with two capital letters, *Mutter-Leib,* and as *Mutter Lyb.* There are here and there other inconsistencies; *nit* and *nicht,* for example, occur side by side. In one instance there is interesting evidence of the determining factor in the choice of a dialectal variant. In connection with the proper noun *Kilchdorf* (the first syllable of which has preserved its dialectal form) we have *Kilchhörj,* but everywhere else the word is *Kirchhörj—Kirchhörj Ansoltingen, Kirchhörj Thieracheren, Kirchhörj Stefiszburg,* but *Kilchhörj Kilchdorf.*

In syntax there is an obvious form-consciousness showing itself in a studious avoidance of repetition and in the display of diversity of expression. For the formula, *the above-mentioned,* there are employed no less than a dozen synonyms—*angeregt, anzogen, jetzanzogen, obanzogen, voranzogen, gedacht, obgedacht, mehrermellt, mehrgedeüt, obgemelt offtgesagt,* and *mehrgesagt.* For the adjective *congenital* there is a formula varied by the use of four different verbs—*von Mutterleib her getragen, -gehabt, -gebracht, -erzihlet,* that convey no significant distinctions of meaning.

A striking preservation of MHG. language characteristics is evident in both documents. There are a number of words entirely unchanged, such as *adenlich, beschechen, eilf, forme(r)klich, har, inne, menigcklich,* and *wolbescheiden.* There are others but slightly modified, such as *erzihlet, weilund, wöllen, zeügsame,* and *ihme,*—in fact there is even an accusative form *ihne,* perhaps by analogy to *ihme.* The MHG. practice of combining the particle *ge* with an infinitive is to be noted in *gedeüten* and *gefolgen.* The MHG. particle *ze* (HG. *zu*) is found in such constructions as *zehaben* and *zecurieren.* The use of the prefix *ver-* for HG. *be-* is found in *verwahrt.* The genitive of *welch* (replaced in HG. by *dessen*) is here *welchessen.* Interesting is the derivation of the High-Alemannic noun *Bott* from MHG. *gebot.* Among the EG. words are *befelch, beschülden, fürbringen, fürsichtig, verartznen,* and *volgends.* The High Alemannic dialect was and is one of the last to outgrow its MHG. and EG. language characteristics. The name itself appears in the "Lehrbrieff" in perfect MHG. form, *Grüeningen,* although the form Grüningen is documented in Zürich in 1374,[11] and in

[11] Strickler, G. *Geschichte der Herrschaft Grüningen,* Zürich 1908 p. 16 *"Grüöninger Ambt"* in 1354, *"vest und stat ze Grüningen"* in 1374.

Freiburg in 1450.[12] In the Saanen dialect the first syllable is still pronounced as a diphthong.

THE TEXT OF THE MANUSCRIPTS

LEHRBRIEFF

Zu gonsten desz wolbescheidnen Ehr und Kunstliebenden Jünglings Isaac von Grüeningens, gebührtig in der Landvogtey Sanen, Berner Jurisdiction.[13]

WIR Obmann Und ein gantze Meisterschafft der Wund- und SchnittArtzney in der Freyen Republic Loblicher Statt Bern geseszen; Thund kund Jedermenigcklichen hiermit Dasz auf heüt zu Endgemeltem Dato vor uns in versambletem Bott Persöhnlich erschinen ist, Der Ehrengeachte, fromme, Ehrsame, and Weise, herr Moses Jants, der Zeith Landaman der Landschafft Sanen, jn gebühr fürbringend, und uns erinnerende, wie das der Ehr- und kunst liebende Jüngling Jsaac von Grüeningen, weilund des Ehrsamen, und wolbescheidnen Peter von Grüeningens säligen us gemelter Landschafft Sanen, zu Ruckgelasner Ehelicher Sohn, vor etwas Zeiths, vor uns der gantzen Meisterschafft, nach diser kunst brauch- und gewonheit, zu dem Ehrengeachten, kunstreichen, fürsichtigen, und weisen Herren Samuel Bischoff, Burgeren, Wund- und Schnitt Artzet der Statt Thun, unserem geliebten Mittmeister auffgedinget worden, bey Jhme die Lobliche künst der Wund-und Schnitt Artzney zu erlehrnen und zuergreiffen; Und nuhn dismahlen seine Lehrzeith zu End gelangt und verflosen, und er auch selbige ordenlich ausgestanden: Jetzundaber vorhabens seye, mit der Hilff Gottes auch andere Ohrt und frömbde Land zu besuchen, undt der Freyen Loblichen kunst noch ferners nach zu werben, darzu Jhme dan ein glaubwürdiger Schein und Lehrbrieff, seines Lehrnens und verhaltens halben von Nöthen seye, dienst freündlich bittende, das wir Jhme selbigen gönstigest ertheillen und gefolgen Lasen wöllind. Wann nuhn solch sein begehren nicht unzimblich, und Jedermenigcklich die Liebe Wahrheit zu befürderen Schuldig. Als sa-

[12] Godet, M. et Türler, H. *Dictionnaire Historique et Biographique de la Suisse*, Neuchatel.

[13] This appears on the back of the manuscript.

g e n d i und bezeügend wir, bey unseren wahren Trewen, das obgedachter J s a a c v o n G r ü e n i n g e n Jn währender seiner Lehrzeith (: so viel uns dismahlen Jn wüsen :) sich From̃, getrew, geflisen, Gottsförchtig und wohl verhalten, bedeüte künst der W u n d - u n d S c h n i t t A r t z n e y, auch alle gutte Handgriff derselben, und was dero anhengig, bey angeregtem seinem Lehrherren, so weit sich die gelegenheit begeben und zugetragen, Loblich und wohlerlehrnet, und sich gegen Jedermenigcklichen Also erzeigt und erwisen, wie es einem Ehrliebenden Lehrknaben wohl ansteht und gebührt: D a h e r o wir uns zu seinem begehren willig geneigt, und Jnne Jn versambletem Meister Bott nach hiesiger gewonheit, seiner ausgestandenen LehrJahren halben, formeklich Ledig und Loosgesprochen, und desendwegen Jhme zu beförden und fortsetzung seiner Erlehrneten künsten, gegenwertigen S c h e i n u n d L e h r b r i e f f, gern Mitttheillen und zustellen wöllen: —— G e l a n g t d e m n a c h an alle und Jede Herren *Doctores Medicinae, Chirurgos,* und *operatores,* und hiermit an Jeden der kunstliebhaberen, als auch meingcklichen (sic), Jn was Hochheit, würden und stand die seyend, unser gantz freündliche und fleisige bitt, Mehrgesagten Jsaac von Grüeningen Jn gönstiger *Recommendation* und befelch zehaben, Jhme umb seiner Ehrlichen verhaltung willen, gunst, Liebe, und alle angeneme befürderung zu erweisen, und zuerzeigen; S o l c h e s umb einen Jeden nach standts gebühr hinwiderumb zubeschülden, wöllend wir uns Jn der gleichen, oder anderen begebenheiten, zu Jeder Zeith gantz willig erfunden Lasen. —— J n n k r a f f t dis B r i e f f s, der desen zu wahrem urkund, mit unserem gewonten groszen Handwercks Jnsigel (: uns, und unseren Erben Jedoch ohnschädlich :) verwahrt und bekrefftiget, von dem underzeichneten geschwornen *Notario* verfertiget, und Jhme von Grüeningen zu seinem könfftigen behelff zugestelt worden. S o B e s c h e c h e n den S i b e n z e c h e n d e n Tag Brachmonats, Als Mann von C h r i s t i des Herren gebuhrt Zalt E i n T a u s e n d, S e c h s h u n d e r t, S i b e n u n d S i b e n t z i g J a h r, 1 6 7 7.

W i l h e l m H e n n i

Notr:

ATTESTATION

ZU Gunsten
Herren Operatoris
Von Grunigen[13]

WIR NICLAUS VON DIESSBACH DES GROSSEN RAHTS Loblicher Statt Bern Und Diser Zeit Schultheiss Der Statt Und Graaffschafft Tuhn (sic); Tuhn (sic) Kund Hiemit; Demnach Der Ehrenhaffte Und Kunst- Erfahrne Herr Ysaac von Grunigen, Oculiss, Bein- Bruch- Schnitt- und Wundartzt, gebürtig zu Sanen, Diszmahlen aber zu Jnterlacken Wohn- und Säszhafft, mir in gebühr zuerkennen geben, waszmaszen Er eine kurtze Zeit dahar von underschidenlichen Elenden, Brästhafften, alten und jungen Persohnen in meiner Amtsverwaltung /: so mit Lystenbrüchen, Hasenscharten und vilen anderen Gefährlichen Leibschäden Behafftet gewesen :/ Einständig Ersucht und gebetten worden, selbige um einen Leidenlichen Preis anzunemen, und volgends von Jhren groszen Leibsgebrästen wo möglich durch Schnitt und *Medicamenten* zuentledigen und ze*cur*ieren, welche er nit nur *admittirt* und angenomen, sonderen auch mit der Hilf und Bystand Gottes Glücklich geschnitten und nachvolgende grosze Leibs *accidenten* in kurtzer Zeit Geheilet, und vermittlest angewendten Fleiszes und erforderlichen *Medicamenten* auf Freyen Fus gestellt habe; Als Erstlich, Herr Statthalter Wincklers Sohn Jacob zu Thieracheren, so fünfzehen Jahr alt, an einem von MutterLeib her getragenen Lystenbruch; Zum anderen Hanns Meyer dem Wihrt zu Bluhmenstein Ein halb-Jährig Knäblin an einem Lystenbruch; Zum Dritten Hanns Mettler zu gedachtem Bluhmenstein ein Mann von Dreysig Jahren an einem sehr groszen und von Mutterleib her getragenen Lystenbruch, wie auch Zum Vierten sein siben wöchiges Knäblin an einem von Mutter Leib her gebrachten Leibschaden; Zum Fünfften Melcher Trachsel von zwanzig Jahren zu voranzognem Bluhmenstein, an einem Zehen Jahr lang gehabten Lystenbruch; Zum Sechsten Christen Stalders sel: Fünfzehen Jähriger Knaben zu mehrgedeütem Bluhmenstein an Einem von MutterLeib her getragenen Lystenbruch; Zum Sibenden Peter Wenger von offt-

gesagtem Ort, von Sechszig Jahren, an einem sehr groszen von MutterLeib her getragenen Lystenbruch, neben noch einem abgeschnittenen groszen Miszgewächs; Zum Achten Christen Küntzi zu Thieracheren ein Eilfwüchiges Zweylling Knäbli, an einem von Mutter Leib her erzihleten Lystenbruch; Zum Neünten Hanns Meyessen von Ubeschj Kirchhörj Thieracheren Ein Jährig Knäblin an einem von Mutterleib her getragenen Lystenbruch; Zum Zehenden Christen Zimermans des Schuhmachers im Kehr zu angeregtem Thieracheren Vier Jährigen Knäblin an einem von Mutter Leib her gehabten Lystenbruch; Zum Eilfften David Garmatter Chorweibel zu mehrermelltem Thieracheren, ein Mann von fünfzig Jahren, an einem sehr groszen Lystenbruch; Zum Zwölfften Haubtmann Hanns Küntzi zu Uttigen Kilchhörj Kilchdorf auf beiden seiten und fünfzehen Jahr Lang gehabten groszen Lystenbrüchen; und Zum Dreyzehenden seiner Schwöster Sohn daselbsten, so Fünfzehen Jahr alt. an einem von Mutter Leib her getragenen Lystenbruch; Zum Vierzehenden Vincenz Sägeszemann dem Nagler im Heimberg Kirchhörj Stefiszburg ein Jährig Knäblin an einem Lystenbruch Geschnitten und Teihls darunder in acht Tagen, Teihl(sic) in zehen Tagen und Teihls in dreyen Wochen wohl *Curirt* habe; Verners und zum Fünfzehenden habe er Hanns Wylers Hausfrau im Lengenbühl Kirchhörj Ansoltingen (sic), ein Frau von vierzig Jahren an einem Fus zwey sonderlich grosze offene löcher, welche siben Jahr lang deszwegen nicht von Haus gehen können und mehr als Einhundert Tahler Vergeblich Verartznet, in kurtzer Zeit wohl geheilet; Zum Sechszehenden Hanns Gaszner von Anzognem Ansoldingen (sic) ein Schänckel an der Hufft hinweggenomen, und in kurtzer Zeit über Jemands verwunderung seiner Schmertzen entlediget und geheilet; Zum Sibenzehenden Hanns Matzinger von Kilchdorf ein Jähriges Knäblin an einer Zweyfachen Hasenscharten wohl geschnitten; Zum Achtzehenden Seckelmr Peter Schwendimann von Stocken an einem Bein so grosz geschwollen, und etliche Jahr lang underschidenliche Löcher darinn gehabt, und in selbiger Zeit vil ohne verspührende hilf darmit geartznet und in kurtzer Zeit wohl *Curirt*, wie dann auch Zum Neünzehenden sein Schwöster an einem gleichen zufahl wohl geholfen und Jhrer

Schmertzen Entlediget; N a c h d e m̄ e ich aber angeregte Persohnen, deszwegen und ihres gehabten zustandes halber Erheischender Nohtdurfft nach durch ihre vorgesetzten befragen laszen, als haben mir dieselbigen angebracht, dasz sie mit oban zognen groszen Leibsgebrästen behafftet gewesen und von denselbigen mit der Hilf Gottes durch Jhne obgemelten Hrn *Operatoren* von Grunigen glücklich geschnitten, und anderer ihrer Leibsgebrästen halber innert kurtzer Zeit wohl *Curirt* worden seyen, Hierüber nun besagter Herr von Grunigen mich freündlich ersucht und gebetten, dasz Jch Ihme, sein sotahnen Verrichteten *Curen* halber einen urkuhndlichen Schein und *Attestation* willfahren laszen wolle, welcheszen begehren ich nit unzimlich befunden, und diewylen auch zeügsame der Wahrheit zusteüren Niemanden versagt, sonderen den begehrenden zu könfftigem behelf erteihlt werden soll, als habe zu wahrem urkuhnd disere *Attestation* durch Endsvermelten geschwornen *Notarium* verfertigen und mit meinem adenlichen Einsigel /: Jedoch mir ohnnachteihlig :/ Verwahrt zustellen laszen wollen. *Actum* den vier und zwanzigsten Augustj des Sechszehenhundert, Neünzig, und fünfften Jahrs 1 6 9 5.

Jos: Fridenrich Gysj
Landtschreiber in Thun Notr:

Z u w üszen s e y e h i e m i t; D a s z a n n o c h v o l g e n d e, v o n Hrn *Operat*or von Grunigen, glücklich verrichtete *Curen* droben vergeszen worden ynzustellen, als Namlich, Hat Er desz Ullj Gerbers am Homberg Knab, Nahmens Niclaus vor (sic. von?) etwa vier Jahren beide bein abgenomen, und in einem Monat wohl *cur*iert, das einte ob dem Knie und das ander under dem Knie, und als er das einte abgenomen, habe der Knab gesagt, mann solle Jhm das andere auch geschwind abnemen; Denne desz Hanns Bürckis Knäblj an der Langenige an einem von Muter Lyb har getragenen Lystenbruch; Wie dann endlich auch Ullj Fahrnj zu Bränzigkosten Freye Gricht Stefisburg zu Beiden Seiten an zweyen Lystenbrüchen, so er by acht Jahren gehabt geschnitten, und in Kurtzer Zeit, allerseits wohl *cur*iert; maszen dann solches, von Jetzanzogner *patienten* Elteren, Wahr seyn *attestier*t, und von denselben hier ynzusetzen begehrt worden. Bynebens hat Haubtmann Küntzj hervoryngesetzt, disere *Attestation*, mit angehenckter Liberey, mehrermelten Hrn von Grunigen, zu bezeügung seines danck-

bahren willens, wegen an ihme glücklich verrichteter *Cur* in seinem eignen Costen, zugestelt und verehrt. *Actum ut Supra.*

Jos: Fried: Gysj
Notr: idem

THE TEXTS IN ENGLISH TRANSLATION

Letter of Release

In favor of the well-beseen honor-and-art-loving youth, Isaac von Grüeningen, born in the provincial district of Sanen, in the jurisdiction of Bern.

WE, Chairman, And one entire Association of Masters of Surgery convened in the Free Republic's Worshipful City of Bern; Make known to Everyone, herewith That today on the date recorded at the end, there appeared personally before us in assembled guild, The respected, upright, honorable, and wise Herr Moses Jantz, former high bailiff and chairman of the district of Sanen, properly placing before us and reminding us that the honor-and-art-loving youth, Isaac von Grüeningen, whilom, surviving, legitimate son of the honorable and well-beseen Peter von Grüeningen, deceased, of the above-mentioned district of Sanen, had some time ago in the presence of our entire association of master surgeons, in accordance with this profession's custom and usage, been duly apprenticed to the honorable, accomplished, discerning, and wise Herr Samuel Bischoff, citizen, surgeon and operator, of the city of Thun, our beloved fellow-master, to learn from him the praiseworthy arts of surgery and incision, and to gain practice therein; Whereas, his apprenticeship has now passed and come to an end, and he has properly completed the same, (and) now intends with the help of God to visit also other localities and foreign countries and to strive after further perfection in the free laudable art, to which end an authentic credential and certificate with respect to his learning and conduct would be necessary, (he) respectfully requests that we kindly grant and issue the same, in case his request be not inadmissable and everyone concerned feel beholden to substantiate the truth. Thus we say and testify upon our honor that the above-mentioned Isaac von Grüeningen has conducted himself during his apprenticeship (: in so far as we now know:) seemly, faith-

fully, assiduously, God-fearingly, and well, learning commendably and well, from his above-named master, (the) important arts of surgery and incision and all good hand-skills of the same, and whatsoever pertains thereto, in so far as the opportunity thereto did present itself and occur, as it well behooves and is meet for an honor-loving apprentice: T h e r e f o r e have we willingly yielded to his request, and, while in session as a guild of masters in accordance with local usage, because of his successfully accomplished years of apprenticeship, be it noted, declared him released and free, and in order to further him and the continuation of his acquired arts, are pleased to grant and deliver this certificate and letter of release; T r a n s m i t t e d h e r e w i t h to each and all *Doctors of Medicine and Chirurgery and operators* and to every lover of arts as well as everyone in whatsoever eminence, dignity, or station they be, our kindly and urgent request to esteem and have favorably in mind the oft-mentioned Isaac von Grüeningen, to render and show him for the sake of his honest conduct: favor, love, and all desirable promotion; T h e n to compensate in return unto everyone as befits his station, we will be found in similar and other events at all times quite ready and willing. B y v i r t u e o f t h i s L e t t e r which through our customary great seal of the guild (:without detriment, however, to ourselves and our heirs:) secures and confirms the same a true deposition prepared by the undersigned sworn *notary* and delivered to von Grüeningen for his future use. S O d o n e this seventeenth day of June as one computes from the birth of Christ the Lord, one thousand six hundred seventy and seven years. 1 6 7 7.

A T T E S T A T I O N
I N F a v o r
of Herr Operator
Von Grunigen

W E N I C L A U S V O N D I E S S B A C H O F T H E G R E A T C O U N C I L O F T H E W O R S H I P F U L C I T Y O F B E R N, A n d A t T h i s T i m e M a y o r O f T h e City and County of Tuhn, Make Known Herewith: That The Honorable And Professionally Experienced Herr Ysaac von Grunigen, oculist, amputator, operator for rupture, incisor, and treater of wounds, native of

Sanen, at present however resident and settled at Interlacken, having duly apprised me to what extent a short time ago he had been urgently besought and requested by diverse miserable, infirm persons old and young within my jurisdiction (who had been afflicted with inguinal ruptures, harelip, and many other dangerous bodily disorders) to accept them for a reasonable price and in ensuance to relieve and to cure them of their great bodily ailments if possible through operation and medical remedies, whom he not only admitted and accepted, but also with the help and succour of God did successfully operate and heal in a short time of the following great bodily maladies and by means of applied attention and requisite *medicaments* did restore to health; In the first place, Chairman Winckler's five-year-old son, Jacob, at Thieracheren, of a congenital inguinal rupture; In the second place, (for) Hanns Meyer, the inn-keeper at Bluhmenstein, a half-year-old little boy, of an inguinal rupture; In the third place, Hanns Mettler, in the above-mentioned Bluhmenstein, a man of thirty years, of a very large congenital inguinal rupture: as also, In the fourth place, his seven-weeks-old little boy of a bodily injury dating from his birth; In the fifth place, Melcher Trachsel, twenty years old, of the previously named Bluhmenstein, of an inguinal rupture had for ten years; In the sixth place, the late Christian Stalder's fifteen-year-old boy, at the repeatedly-stated Bluhmenstein, of a congenital inguinal rupture; In the seventh place, Peter Wenger of the oft-said locality, sixty years of age, of a very large congenital inguinal rupture, besides also a large misgrowth cut off; In the eighth place, (for) Christian Küntzi of Thieracheren, an eleven-weeks-old twin boy, of an inguinal rupture dating from birth; In the ninth place, (for) Hanns Meyessen of Ubeschi, parish of Thieracheren, a year-old little boy of a congenital inguinal rupture; In the tenth place, a four-year-old little boy of Christen Zimmern, the shoemaker at Kehr, in the referred-to Thieracheren, of an inguinal rupture had from birth; In the eleventh place, David Garmater, choirmaster of the several-times-mentioned Thieracheren, a man of fifty years, of a very large inguinal rupture; In the twelfth place, Captain Hanns Küntzi of Utigen, parish

of Kilchdorf, of large inguinal ruptures on both sides had for fifteen years; In the thirteenth place, his sister's son thereat, some fifteen years old, of a congenital inguinal rupture; In the fourteenth place, (for) Vincenz Sägeszemann, the nail-maker in Heimberg, parish of Stefiszburg, a year-old little boy, operated for an inguinal rupture and successfully cured the same, partly (thereunder) in eight days, partly in ten days, and partly in three weeks; Furthermore and in the fifteenth place, that he had well healed in a short time Hanns Wyler's housewife at Lengenbühl, parish of Amsoldingen, a woman of forty years, having on one foot two exceptionally large open sores, who because of them could not go out from her house for seven years and had uselessly spent more than one hundred Thalers for doctors and medicines; In the sixteenth place, (for) Hanns Gaszner of the said Amsoldingen, amputated a femur at the hip, and in a short time to one's amazement relieved him of his pains and healed him; in the seventeenth place, Hanns Matzinger's one-year-old little boy, of Kilchdorf, a double harelip successfully operated; In the eighteenth place, Peter Schwendimann, treasurer of Stocken, one leg greatly swollen and for several years affected with different open sores, in which time he had doctored much without noticeable help, well cured in a short time; as then also in the nineteenth place, his sister well helped of a like malady and relieved of her pains; Whereas, I now have caused the afore-mentioned persons to be questioned thereabout and as to their former condition, inquiring in so far as necessary* of their superiors, thus have they reported to me: that, having been afflicted with the above-mentioned grave bodily diseases, they had with the help of God been successfully operated by him, the above-mentioned Herr von Grunigen, surgeon, and within a short time well cured of their other bodily ills; Now since in this matter the said Herr von Grunigen has kindly requested and besought me, that I, because of his so-accomplished recoveries, grant an official Certificate of Attestation, which request I have not found improper, and since, moreover, testimony contributing to the truth should be refused no one but delivered to petitioners for (their) future help, therefore (do I) cause

* That is to say, in the case of children.

this attestation made a true legal document through the sworn notary entered below and secured (however without detriment to myself) with my noble seal. Done August the four and twentieth of the sixteen hundred ninety and fifth year 1 6 9 5.

Jos. Fridenrich Gysi, Notary
Clerk in Thun

Be it known herewith, that to be included are also the following successfully accomplished cures of Herr von Grunigen, surgeon, forgotten above; namely, about four years ago he amputated both legs of Ulli Gerber's boy, Niclaus, at Homberg, and satisfactorily cured him in a month, the one above the knee and the other below the knee, and after he had taken off the one, the boy is said to have said that the other should also be quickly taken off for him; then Hanns Bürcki's little boy of Langenige of a congenital inguinal rupture; and then finally also Ulli Farni of Bränzigkosten, free-district of Stefisburg, two ruptures, on both sides, that he had had for about eight years, operated and completely healed in a short time: subsequently investigated these and through the here-mentioned patients' parents attested as being true, and desired by them to be here included; moreover, the hereabove-stated Captain Küntzi, to give proof of his grateful disposition because of the successful cure accomplished upon him, has at his own expense delivered and presented this Attestation with appended postscript to the repeatedly-mentioned Herrn von Grunigen. Actum ut supra.

Jos: Frid: Gysi
Notr: idem

Spelling Practices

In the appended Glossary is an alphabetical list of words now obsolete or current only in dialect. Words the spelling of which differs but little from that of today are not included. The following practices are to be noted:

(1) The use of *tz* and *dt* after liquids and nasals where HG. has *z* and *d* respectively—Artzt, gantz, kurtz, sibentzig, schmertzen, sandt, etc.;

(2) The use of an unassimilated labial after corresponding nasal, i.e. *mb* for *m*, *nt* for *n*—hinwiderumb, versambletem, frömbde, unzimblich, desendwegen, einte;

(3) The appearance of lenis labials where HG. has fortis—Haubtmann, darunder, underschidenlich;

(4) The doubling of voiceless stops and affricates, as *ck* for HG. *k*, *tt* for *t*, *ff* for *f*—Interlacken, Schänckel, gutt, auff, Brieff, Graaffschafft, behafftet, Nohtdurfft, bekrefftigt;

(5) The omission of *h* where it is used as a sign of lengthening in HG.—anzunemen, gewont;

(6) The insertion of *h* as a sign of lengthening and its use as a final letter where it is not used today—Bluhmenstein, danckbahr, dismahlen, erlehrnet, gebührtig, nahmens, nuhn, Ohrt, Persohnen, Raht, Tahler, tuhn, Wihrt, Zeith;

(7) The use of pure back vowels where HG. has corresponding umlaut or diphthongization—Burger, hufft, loblich, us, Zalt, zuRuckgelasner;

(8) The use of single *s* where HG. has *ss*—wüsen, lasen, geflisen, desen;

(9) The use of both *y* and *ei*, giving us side by side the spellings: Lyb and Leib, *yn* and *ein* (ynzusetzen, hievoryngesetzt, and einständig, Einsigel, where HG. has inständig, and Insiegel);

(10) The diphthong *ey* and *y* where HG. has *ei*—bey and by, Lystenbruch, diewylen, dreysig, frey, seye, zweyfach, zweylling;

(11) The umlauting of *u* in the diphthong *eü*—freündlich, gedeüt, heüt, neün, zusteüren;

(12) The MHG. spelling of syllables having *i* without the use of *e* as in HG.—diser, siben, vilen;

(13) The rounding of *e* and *i* in speech, accounting for the spellings—frömbde, Schwöster, wüsen;

(14) The phonetic spelling of sälig, sässhaft, Schänckel, gönstigest, Gottsförchtig, befürderen, bekrefftiget, eilfwüchig;

(15) The use of unweakened inflectional and other syllables especially *en*, *est*, and *et* where HG. has contraction—anderen, bekrefftiget, gönstigest, leidenlich, vermitlest;

(16) The use of contracted forms—gemelt for gemeldet, geacht for geachtet, Gricht for Gericht;

(17) The use of an overlined $\bar{m}$ and $\bar{n}$ to signify doubling.

Glossary

Abbreviations used

a. ——— adjective
adv. ——— adverb
Al. ——— Alemannic
B. ——— Bern(ese)
dat. ——— dative case
dial. ——— dialect(al)
EG. ——— Early Modern High German
f. ——— feminine
F. ——— French
HG. ——— Modern High German
gen. ——— gentive case
Goth. ——— Gothic
P-G ——— Paul-Gierach *Mittelhochdeutsche Grammatik*, Halle, 1929
infin. ——— infinitive
L. ——— Latin
LL. ——— Late Latin
m. ——— masculine
MHG. ——— Middle High German
n. ——— noun
neut. ——— neuter
num. ——— numeral
OHG. ——— Old High German
p. ——— particip(le) (ial)
pl. ——— plural
prep. ——— preposition
pres. ——— present
pron. ——— pronoun
rel. ——— relative
sing. ——— singular
S-T ——— Staub-Tobler *Schweizerisches Idiotikon* Frauenfeld, 1891
v. ——— verb
w. ——— with

adenlich, *a.* [MHG. *adenlich*, HG. adelig.] Noble.

angeregt, *past p.* [EG. *anregen* to touch, HG. *anregen* to mention.] Mentioned.

anzogen (jetzanzogen, obanzogen, voranzogen), *p.a.* [EG. *anziehen* to quote.] Mentioned; named; designated.

bedeüte, *a.* [MHG. *bediuten* to make understandable; *bediute, adv.*, HG. *bedeutend.*] Important; significant.

befelch, *n.m.* [MHG. *bevelhen* to commit to someone's protection; EG. *befelch* recommendation, memory.] Mind; memory. *"Jn gönstiger Recommendation und befelch zehaben"* to esteem and have favorably in mind.

beschechen, *past. p.* [MHG. *beschëchen*, EG. *geschehen* to come to pass.] Done; enacted.

beschülden, *v. infin.* [EG. *beschülden* to reimburse, to fulfill.] To compensate for; to repay.

Bott, *n.m.* and *neut.* [MHG. *gebot*, Al. dial. *D's gross Bott* "die ... Hauptversammlung der ... Zünfte in Bern." (Cf. S-T 4:

1896) B. dial. *al bot einmal* now and then.] The semi-annual general session of the Bernese guilds.

brästhafft, *a.* [HG. *bresthaft.*] Invalid; infirm.

dahar, *adv.* [HG. *daher.*] Therefore, therefrom.

eilf, *num.* [MHG. *eilf<ein-lif*; HG. *elf.*] Eleven.

erzihlet, *past. p.; infin.* erzihlen. [MHG. *erziln* produce; generate. For introduction of gutteral *h* after *i* in B. dial. cf. *cho ichi* come in; HG. *erzielen* obtain.] Brought forth. *"Von Mutterleib her erzihlet"* Dating from birth.

formeklich, *adv.* [MHG. *for* + *merklich* before + notably; for elision of *r* cf. HG. *fodern,* variant for *fordern* < OHG. *fordarôn.*] To be well noted.

fürbringen, *v.* [EG. *einem etwas fürbringen* to place before someone.] To place before.

gedeüten (mehrgedeüten), *p.a.* [MHG. *diuten* show, designate. See also No. 11 under "Spelling Practices" above. The particle *ge-* is here combined with the infin. as in MHG.] To show; refer.

gefolgen, *v.* [HG. folgen.] To follow.

har, *adv.* [HG. her.] Here; hither.

ihme, *pers. pron. dat. sing.* [MHG. *im.* In the older MHG. mss. the dat. sing. is *ime*; cf. P-G p. 100.] Him.

ihne, *pers. pron. acc. sing.* [MHG. in.] Him.

inn, *prep. and adv.* [MHG. inne.] In.

inne in, *adv.* [Cf. MHG. *in diu* during; *Jnne jn* while inside.] Within; while in session.

innert, *prep. w. dat.* [Cf. B. dial. innet, S-T 1:295.] Within.

jnn, see inn.

jedermenigcklichen, see menigcklich.

jetzanzogner, *p.a.* (See anzogen.) Now designated.

Kilchhörj, *n.f.* [*Kilch* Al. dial. church; EG. *hören,* HG. *gehören* belong.] Parish.

Kirchhörj, *n.f.* [MHG. Kirch-hoere] Parish.

Landaṁann, *n.m.* [Goth. *andbahti;* OHG. *ambat;* MHG. *ambet;* HG. *Amt; lant* +*ambet* + *man* an official pronouncing sentence; burgomaster.] High bailiff; chairman.

Leibsgebrästen, *n* (See brästhafft) Bodily ailments; infirmities.

leidenlich, *a* [HG. *leidlich.* See No. 15 under "Spelling Practices" above.] Fair; reasonable.

Liberey, *n.f.* [LL. *liberare* to deliver; HG. *liefern.*] That which is delivered herewith(?); ". . . *mit angehenckter Liberey*"

evidently here synonymous with appended codicile or postscript.

mehrgedeüten, *p.* (See gedeüten.) Repeatedly referred to.

meingcklichen, (Evidently this spelling is owing to a misplaced "i" dot. See menigcklich.) Everyone.

Nohtdurfft, *n.f.* [MHG. *nôtdurft.*] Necessity. *"Erheischender N. nach"* inquiring in so far as necessary.

menigcklich (jedermenigcklichen), *adv.* [MHG. *menic a.* many; *manig n.f.* multitude. When *all-* or *jeder-* is combined with *männig* the meaning is, general, universal. S-T 4:293.] To everyone. *"Thund kund j. hiermit"* herewith make known to everyone.

obanzognen, *p.a.* (See anzogen.) Above-designated; mentioned.

Obmann, *n.m.* [In B. Präsident bei . . .Gemeindeversammlungen, usw." S-T 4:245.] Chairman; presiding officer.

Secklmr, (Säckelmeister) *n.m.* [MHG. *seckel* money bag.] Treasurer.

Schultheiss, *n.m.* [OHG. *scultheizo* one who assigns duties and tasks; town mayor "Das der Chuehirt zum Schultis is worde" S-T 2:1684.] Chief magistrate of a city or town; mayor.

sotahnen, *p.a.* [EG. *sotan* such.] Such; so done.

Statthalter, *n.m.* [In 1436 vice-mayor. "Wenn ein schults von der statt ryt, dass er dann soll ein statthalter haben." S-T 2:1684. In Thierachern about 1700 "eine von der Obrigkeit angestellte Amtsperson, die den Landvogt oder Schultheiss von Thun im Bezirksgericht vertrat und zugleich Vorsteher des Dorfes Thierachern war." —R. Feller. See footnote 12.] Chairman.

Trewen, *n.f. pl.* [HG. *treu.*] Good faith; honor. *"Bey unseren wahren Trewen"* Upon our honor.

verartznen, *v.* [EG. *verarz(e)nen.*] To spend money for doctors and medicines.

verwahrt, *v.* [MHG. *verwarn;* HG. *bewahren.*] Secure; keep.

volgends, *adv.* [EG. *folgends.*] Consequently; ensuingly.

voranzognen, *p.a.* (See anzogen.) Before-mentioned.

vorhabens, *pres. p.* [HG. *vorhaben.* Al. dial. *vorhabens sin* w. *zu* and *infin.* to intend to. "Wenn d'r vorhabes sid, wider z'boue." S-T 2:910.] Intending. *"Jetzundaber vorhabens seye . . . zu"* Now intends to.

während*er*, *p.* [MHG. *wern;* OHG. *wëren* to last; HG. *während prep. w. gen.*] During. *"Jn währender seiner Lehrzeit"* during his apprenticeship.

weilund *a.* and *adv.* [OHG. *wilom;* MHG. *wilent;* HG. *weiland.*] Former(ly); whilom.

welchessen, *rel. pron. gen.* [MHG. *welch* and *wilch.* HG. *welcher gen.* replaced by *dessen.*] Whose.

wolbescheiden, *a.* [MHG. *bescheiden* informed; HG. *bescheiden* moderate, modest; cf. *beschieden* endowed.] Seemly; well-beseen.

wöllen, *v.* [MHG. *wellen.*] To will; to be determined.

ze- *prep.* and *particle* [MHG. *ze*; HG. *zu.* Cf. *zehaben, zecurieren.*] To.

zechen, *num.* [HG. *zehn.* See No. 11 under "Spelling Practices" above.] Ten.

zeügsame, *n.f.* [MHG. *ziugsame.*] Proof; testimony.

AMLETH'S SHIELD: A COMMENT ON THE PICTORIAL ELEMENTS OF THE HAMLET STORY

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Pictured background and the spectacular aspects of action are powerful factors—factors both creative and preservative—in the evolution of all story. A good case could be made for the possibility that Shakespeare's selection of material was as often determined by picture-evoking passages as by any other element in his sources.

Behind Belleforest, French narrator of the sixteenth century, behind Saxo Grammaticus, Danish historian of the end of the twelfth century, scholars have pursued teasing resemblances to the Hamlet story. Professor Kemp Malone has followed them in the region in which our own epic literature had its birth. The researches of Sir Israel Gollancz and others have traversed not only Denmark but Iceland, Ireland, and Mediterranean lands. Dr. Schick has been lured to India and China. Space does not permit us to recapitulate these adventures nor to review the treasury of stories thus collected. We may note only that Gollancz finds the first mention of Hamlet in a brief quotation from the poet Snaebjörn (preserved by Snorri Sturlason, who wrote about 1230):

> 'Tis said that far out, beyond the skirts of the earth, the Nine Maidens of the Island Mill stir amain the host-cruel Skerry-quern—they who in ages past ground Hamlet's meal. The good Chieftain furrows the hull's lair with his ship's beaked prow.

Gollancz thinks "the underlying reference is certainly to the great world-mill deep down in the sea, the great cosmic force, which the ancient Northerners and other races conceived as the cause of storms and showers, and of all the disintegrating changes wrought on mountains, rocks, and shores."

With Saxo and Belleforest we are nearer home—not so far from the beat of the casual reader, who turns to Shakespeare for poetry and drama, not for curiosities of scholarship. Even here, however, most readers do not know the material well

enough to draw from it a larger imaginative experience into which they can fit Shakespeare's *Hamlet*.

Gollancz says, in the Introduction to his *Sources of Hamlet* (1926), "Geoffrey's priceless gift of Arthurian romance has not proved richer than Saxo's wild barbaric tale of Hamlet's fate." The events of the old tale may be found summarized in most of the popular introductions to Shakespeare's play, but the reader is urged to go back and read the whole story in Elton's translation of Saxo's sonorous Latin.

It is at least in part because of the pictorial quality of his story that Saxo's version has such vitality. It is interesting that Saxo was quite aware of these pictorial elements, enjoyed them to the full, and himself sums them up in a remarkable passage describing Amleth's shield. The pictured shield is of course conventional in epic literature, expressive of the more or less reflective love of stopping the onward movement of time and holding the picture as an arrested thing, and also the naïve love of the whole story in its successive stages made simultaneously visible. The passage is here quoted in full because it suggested the present study and serves as its point of departure.

> He also had a shield made for him, whereon the whole series of his exploits, beginning with his earliest youth, was painted in exquisite designs. This he bore as a record of his deeds of prowess, and gained great increase of fame thereby. Here were to be seen depicted the slaying of Horwendil; the fratricide and incest of Feng; the infamous uncle, the whimsical nephew; the shapes of the hooked stakes; the stepfather suspecting, the stepson dissembling; the various temptations offered, and the woman brought to beguile him; the gaping wolf; the finding of the rudder; the passing of the sand; the entering of the wood; the putting of the straw through the gadfly; the warning of the youth by the tokens; and the privy dealings with the maiden after the escort was eluded. And likewise could be seen the picture of the palace; the queen there with her son; the slaying of the eavesdropper; and how, after being killed, he was boiled down, and so dropped into the sewer, and so thrown out to the swine; how his limbs were strewn in the mud, and so left for the beasts to finish. Also it could be seen how Amleth surprised the secret of his sleeping attendants, how he erased the letters, and put new characters in their places; how he disdained the banquet and scorned the drink; how he condemned the face of the king and taxed the queen with faulty behaviour. There was also represented the hanging of the envoys, and the young man's wedding; then the voyage back to Denmark; the festive celebration of the funeral rites; Amleth, in answer to questions, pointing to the sticks in place of his attendants, acting as cup-bearer, and purposely drawing his sword and pricking

his fingers; the sword riveted through, the swelling cheers of the banquet, the dance growing fast and furious; the hangings flung upon the sleepers, then fastened with the interlacing crooks, and wrapped tightly round them as they slumbered; the brand set to the mansion, the burning of the guests, the royal palace consumed with fire and tottering down; the visit to the sleeping-room of Feng, the theft of his sword, the useless one set in its place; and the king slain with his own sword's point by his stepson's hand. All this was there, painted upon Amleth's battle-shield by a careful craftsman in the choicest of handiwork; he copied truth in his figures, and embodied real deeds in his outlines. Moreover, Amleth's followers, to increase the splendour of their presence, wore shields which were gilt over.

Saxo's word pictures are not confined to the shield passage. One detail of the final scene of vengeance in the hall of the palace is arresting and may be highly significant, since it might serve, in the absence of other evidence, to suggest to us that the Elizabethan dramatist, through whatever intermediate version the plot was obtained, did not fail to consult Saxo directly: "Then, to prevent his loose dress hampering his walk, he girded his sword upon his side." (*Et ne gressum laxior vestis offenderet latus gladio cinxit*). Surely the energetic outlines of this figure reappear in "my sea-gown scarfed about me".

These and certain other pictorial passages, which we have not space to review here, are omitted in Belleforest's version. Belleforest lacks the zest, color, and rhythm of movement found in Saxo, and he is more given to moralizing. His pious reflections, however, humble metal as they are, the alchemy of Elizabethan poetry could transmute into Hamlet's address to Horatio and his meditation on the range of human nature from brutality to the apprehension of a god. Belleforest's passage on the black art, too, may have combined with another stage tradition to suggest to the dramatist how to make full use of the ghost, not only as a spectacular element in the outer action, but as a mysterious and supernatural agent stimulating to the lurid pageantry of the mind.

Much of the spectacular element common to the two narratives no doubt conditions the dramatic form. For example, in the concluding scenes of vengeance, different as these are from the scenes of the play, it is easy to see how the pictures called up in the mind of the Elizabethan dramatist may have given him hints both for color and for action: grim humour in the midst of horror, unseemly behaviour at what was to have been a fun-

eral, the spectacle of cumulative, onrushing disaster. *To the dramatist*:—we should perhaps here say, *to the dramatists.* I have purposely refrained from theorizing on how far Shakespeare may have been dependent on an earlier drama for access to this material. But whatever may be the extent to which *Hamlet* is derived from an Ur-Hamlet, it seems to me by no means proved that before giving his play its final form Shakespeare did not make every effort to consult all available versions of the story.

Highly significant in the scene of vengeance, is the withdrawal of Fengon from the banquet hall. Perhaps no scene of Shakespeare's play has been the center of more controversy than that in which Hamlet spares Claudius at prayer. The dramatist may have introduced the incident in the first place in order to make use of the spectacular element suggested by Belleforest of a scene by night in the king's chamber; he may have added the circumstance of the king's praying, in order to avoid following Belleforest to the end of the scene, and thus ending his story prematurely. The scene having been introduced, Shakespeare exploits it dramatically.

Later variants of the story of course do not directly concern any problems of the Shakespearean play. Yet there may be a point in noting how certain elements have elsewhere been seized on and given emphasis, how the germ has grown in new soil and what it has grown into.

The popular (late) story of Brjám, contains a strange mixture of elements, a fairy tale atmosphere, an intelligent cow, able to come by herself home from the pasture, a king a-hunting, whose wish for the cow recalls the parable of the ewe lamb, the killing of her owner by the king's men, the strange callousness of Brjám, who is let live "for he was a witless fool"; riddling questions, and words that miraculously fulfill themselves (the boy is told by his mother what to answer and always gives the right answer too late and is punished); the king's banquet, the whittling of pieces of wood, garments nailed to the floor, and guests killing each other; a happy ending. Brjám is accepted as the queen's servant and at last "married the king's daughter, and became king in that realm, and laid aside all his harebrained folly. Thus ends this story."

In this folk tale (as in aspects of the Havelok material dealt with by Gollancz) the sub-normal element is strangely linked with the super-normal. Idiocy has a subterraneous connection with powers of divination, and these are combined in Brjám with the word that has the power to fulfill itself. These overtones, or undertones, haunt the various versions; and it is possible—we are again reminded—that in Shakespeare one of their palpable ways of emerging is in the person of a ghost, a being of another ancestry, yet perhaps also a spontaneous expression of the magic element of the story.

In the *Ambales Saga,* a northern variant belonging to the sixteenth or early seventeenth century, spectacular elements are present in profusion: the big unsightly man-child "dark-skinned with bristle hair, black as coal, yet beautiful by reason of his eyes", cursed by the witch ("all men shall hold him witless"), scorned of the king; the sad queen rocking the cradle; the prince strangely callous to the horrible death of father and brother; the usurper crowned in the kingly seat, sceptre in hand; the queen forced to be called his consort, though her person is protected by an enchantment; the prince haunting the kitchenstead, careless in dress, ugly and contrary in behaviour, whittling wooden spits, playing the fool at the king's feast, threatening the king with sword-play, sent to be a herdsman and scattering the flocks, but defending the herdsmen against giants and robbers; the herdsmen in the king's hall; the king's comment—"Amlode's words [the form of the name varies] are wise and witless", a storm raging "so that towers fell far and wide"; the uproar made by Ambales in the queen's chamber, the queen keeping quiet in her bed, the sewing maids huddled in terror, the steward crouching under the bed; Ambales, unknown to any, killing the steward with his spear and afterwards at night successfully disposing of the body; the prince betaking himself "to woods and wastes as was his wont"; the dragon-ship "with golden vanes and wanded sails . . . all steel-bound down to the water mark", the rocky strand of Scythia, a wilderness, a farmstead, a mid-day meal and sleep beside a stream; the banquet in the hall of Tamerlaus; the second sight of Ambales, who reveals the king's secrets; the Yule-tide festivities in Cimbria; the prince disguised, a cloak over silken raiment, a grotesque mask over his face, the spits hidden in a

leathern bag; the prince playing the fool, resting under the benches, pinning down the robes of drunken courtiers, the bundle cast into the queen's lap, flung to Gamaliel, Gamaliel reading the letter in a whisper in the ear of the queen, her weeping, her passing out of the hall; the fool going on with his pranks so as to turn their minds from the departure of the queen, carrying Gamaliel gently from the hall, slamming the door, leaping over the threshold as the flames burst forth from a bundle which lay there; the hall ablaze.

Here the essence seems to be the wronged and thwarted one, —child, yet growing into man; horror unconfessed, fear and cunning, half-idiocy; all power held down and driven into devious channels, a spirit isolated, at odds with its world, brooding and waiting, repellant, yet not wholly unlovable, commanding the reader's sympathy. In fact, there seems to be here a curious identification of writer, and perhaps reader, or rather story-teller (who is a little of both) with Ambales the thwarted one; and the resolution of the story has some of the typical psychology, more or less infantile, of wish fulfillment. The outcast becomes king; the isolated one wins friendship; the thwarted one becomes the powerful. There is pathos in the wary cunning with which the identity is guarded, the natural impulse ever reversed, the secret hidden. None may pluck the heart out of his mystery. It is the story of the naughty child who is, however, the wronged child. A strange wistfulness runs throughout: the wound and the queen mother bathing it; the shelter of the queen's chamber; the occasional kindness, like coals of fire; the fierceness of the final revenge; the sense of release when it is over, as of a suddenly dispersed storm; the serene ending. In the final release of the *Ambales* saga the dream quality lingers, is most apparent.

To read the variants through swiftly and continuously is to emerge with a sense of a great vitality, a panorama of the most intense color, an action of unparalled energy. The scenes, whether in primitive or sophisticated forms, are a phantasmagoria intoxicating to the imagination, philosophically blind as a dream at times, yet with a tantalizing hint of other than literal implications, and in the final version wrought into coherence and compelled to yield its hidden meaning. It is an illusion of course that the whole flowering of the tale was in the germ from the

beginning. Yet something fertilizing at least was there which in the matrix of the human mind has grown like the tree of the world until the philosophies of mankind have nested in the branches.

The theme throughout the various versions is the great one of thwarted human nature, bursting its bonds at last into action. The theme of the Shakespearean play is enlarged to comprehend the range of human nature from beastliness to divinity, which Hamlet harps on morbidly, his mind obsessed with it. And this element has to do with the central problem of the play: is Hamlet essentially incapable of action—only able to act under sudden spur, or is he, however gradually and painfully, integrating himself for action? Is his mind on the whole retreating from action or setting toward action? Is this a story of a mind bound by lethargy and thwarted by a time out of joint, at length freeing itself to be itself? The old story in its variants seems to lend color to the latter idea. Nor could there be a dramatic motif of more universal appeal, since all human life is just that,—a struggle for release, of a spirit, somehow imprisoned, bounded in a nutshell, yet fit to be king of infinite space.

Shakespeare has gathered up the values of this terrible old tale and let no part escape. The prince of mysterious endowment is here—gifted with powers of self-preservation and vengeance, of cunning and patient delay and of violent action; isolated and self-contained, brooding and perverse, haunted with evil and in league with supernatural agencies, at odds with his universe and finally triumphing over it; baffled, disillusioned, and the victim of wrong.

In all literature where is there anything as spectacular as this play? On Hamlet's shield what pictures are painted—the still cold of the platform, the august figure of the dead king stalking in the moonlight three times past the watch, the prince freeing himself from his companions to follow it, swearing his companions to secrecy upon the hilt of the sword; the new king speaking from his throne, the prince sombre among the figures of the courtiers; the disheveled Hamlet looking over his shoulder at frightened Ophelia; Ophelia giving back her gifts; the play scene, the furtive Hamlet, the shrinking Claudius, the watching Horatio; Claudius at prayer, and the sinister figure behind him; the queen weeping in her chamber, Hamlet crying out after the

Ghost, who glides across the chamber like a mote on the eyeball —"Look where he goes e'en now, out at the portal"; Hamlet holding the pictures before the queen, Hamlet dragging in the dead Polonius; the soldiers of Fortinbras marching; Hamlet, his seagown girt about him, sealing the letters; the sea-fight; Laertes holding the door against the mob; Ophelia scattering her flowers; Hamlet with the skull in his hand; the funeral procession; Hamlet grappling with Laertes in the grave; Hamlet wounded by the envenomed point, stabbing the king, wresting the cup from Horatio; borne aloft to the solemn tramp of feet and the music of the dead march.

In Shakespeare the whole treatment is indefinitely deepened —the outer spectacle reflected in a procession of mental images: the trappings and the suits of woe; the unweeded garden of this world; Hyperion, and a satyr; Niobe all tears; the sepulchre opening ponderous and marble jaws; the trivial, fond records of youth and observation; Yorick, romping with the little prince on his back; with his flashes of merriment setting the table on a roar; a sterile promontory and a foul and pestilential congregation of vapours; the players and their parts—king, knight, and lover, clown, and lady; the guilty creature sitting at the play. Here the theme is repeated in another register, in the tortured idealism which is part of the thwarting. Outer and inner movements come together in the great final spectacle, where the terrible release into action is followed by an encompassing silence—a silence that itself finds voice in the steadfast continuance of Horatio and his voluntarily assumed responsibility. The childish ending is gone, its place taken by a profounder resolution.

For this prince was more than the brooding, violent hero of the old barbaric story; knew other scruples and fears, ideals, illusions, affections, duties; yet stood no less isolated in a world no less baffling and hostile, where man's own part was a question

> Whether 'tis nobler in the mind to suffer
> The slings and arrows of outrageous fortune,
> Or to take arms against a sea of troubles.

Indeed so have all these vistas extended and deepened that the whole is like some great tapestry hung in too shallow a chamber;

we cannot see it all at once; it does not come perfectly into focus.

Hence in the interpretation of the play much is forever uncertain, affording matter for perpetual controversy. The element of mystery in the central figure is always emphasized, of repression tending toward madness, sullen, secretive, shrouded in both physical and psychological disguise; and the atmosphere that hangs over it too is mysterious—a sombre and stormy background, and a driving and looming fate that universalizes the story and hints at cosmic significances. Even individual consistency seems at times subordinate to this pictorial, atmospheric, and reflective element. *Reflective* seems the best word to characterize the intellectual factor; for the mind seems less a logical and directing agent than an imaginative and passive mirror of experience, correlating through picture, rather than reason, and arriving less at explanation, than mystery and awe, the true tragic mood. Yet it does not preclude explanation, and the whole drama remains, more than any other story, the fascinating material of philosophic thought. Nor is this to say that the apparently passive elements in Hamlet's mind are not crystallizing into will to action; for they are here presented in an essentially poetic medium, just as great effort, seen in retrospect, seems to have sunk into passivity, partaking of the lethargic quality of a dream, and the things one has done with intensest output of energy seem only to have happened to one.

In Hamlet whether or not we find a "tragic" flaw in any Aristotelian sense, there is the bewilderment of an eager mind, contemplating life, wrestling with it, struggling to drag forward the clogging weight of mortality. At best the reflective mind integrates slowly, but in proportion as it is honest, its very reflection is a struggle toward integration. Perhaps Shakespeare came at the character more or less by accident, being acted upon himself, as he worked at the material, not merely by suggestions in the prototypes of Hamlet but by reactions in himself to elements of Hamlet's story. If his own imagination is somewhat passive before the spectacle, absorbed in its chiaroscuro, the character of the central figure, giving to the author and the reader as it does a point of view from which to look at the panorama of the action, will take on at moments a passive and reflective aspect. Motion, moreover, is relative. Even though

Hamlet be moving, fate moves faster; literally his destiny overtakes him; yet he collects himself in time to turn upon it. There was delay—true; so was there in the old story; so is there in life—pitiful delay, even in the course of respectable achievement; and at last the task is done, after a fashion, accidents aiding our will, accidents making it appallingly miscarry, and nothing quite as we would have it be. "The readiness is all"—to pull ourselves together somehow, somehow to face the issue. The spectacular aspect of Hamlet goes deeper, then, than mere consideration of theatrical effect and Elizabethan popular appeal.

To sum up, Saxo, finding stimulus for his imagination in legendary material of both southern and northern Europe, was in love with the pictorial elements of the Hamlet story. These elements of sombre background, violent action, and mystery of the mind have persisted both through Belleforest to Shakespeare, and in variants of Icelandic literature. Because of the energy with which Shakespeare's imagination dealt with the old materials, they are in his *Hamlet* turned into profound drama. Yet the spectacular element is still strong as a conditioning factor; it furnishes much of the suffusing atmosphere of poetry; and many of the major difficulties of the play are illumined by reference to its naïve origins. Verily the great world mill has ground Hamlet's meal.

A SUGGESTION FOR A HISTORY OF SHAKESPEAREAN CRITICISM BY PLAYS

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The field of Shakespearean study has been and is so rapidly enlarging that even the most limited and modest contribution has now to be preceded by extended research, if the student is to orient himself accurately enough to be sure what has and what has not already been done on the point he has in mind—if he is to get out to the frontiers of his subject and know positively that he has succeeded in doing so. Valuable as are the recent bibliographies and surveys, a more complete apparatus of orientation is greatly needed.*

It may be very soundly argued that it is more possible to do an original interpretation of a play if we do not know too much about what has been said on it already. Even so, the most independent of critics is or ought to be glad to check his own findings with those of others before giving his own their final form, especially if the checking can be done without too great outlay of energy and time. And it is all to the good to have the means of arriving at the weight of opinion on any issue and to see how ideas recur and with what varying emphasis.

The writer would suggest that a history of Shakespearean criticism more complete than any at present available be undertaken *by plays*—a volume being devoted to each play—to include for each play a chronological survey of research and criticism from the beginning to the present time.

If the work is to fulfill its purpose, the following fields at least would have to be taken into consideration:

(1) textual criticism
(2) line by line criticism
(3) studies of background and sources

* Since this suggestion was presented at the meeting of the Wisconsin Academy of Sciences, Arts, and Letters in June, 1936, the need has been met in part in the case of *Hamlet* by the invaluable work of Mr. Anton Adolf Raven, *A Hamlet Bibliography and Reference Guide, 1877-1935* (University of Chicago Press, 1936). This work does not, however, undertake to give a chronological development of the subject.

(4) the stage history of the play
(5) various types of interpretative criticism

Now the first two—textual and line by line criticism—have been dealt with in the *Variorum* down to the date of publication or will be dealt with as the work of the *Variorum* is continued. This work of course should not be duplicated. The other fields, however,—more especially studies of background and sources, and general criticism,—would have to be thoroughly surveyed, and all fields would have to be chronologically correlated.

The exhaustive bibliography which Dr. S. A. Tannenbaum, secretary of the Shakespeare Association of America, has in hand would be invaluable as a starting point.

It would be of the utmost advantage to the present project to proceed in the rear of the *Variorum* and to make use of the winnowed harvest of material in the volumes already issued and the forthcoming volumes. It must be re-emphasized, however, that the purpose of the history is quite different from that of the *Variorum*. The *Variorum* is concerned primarily with providing an apparatus for understanding the play. The object of the history of criticism, on the other hand, is to throw into perspective the story of the impact of the play on the human mind, to give a chronological account of the growth of knowledge of the play, and the development of thought about it. It would proceed by years, decades, half centuries, summing its findings at regular intervals, or as organic divisions might appear in the material in consequence of conditioning events or influences. Even negative results would have to be included to some extent, for it is important to know when a line of investigation has led only to a dead end. The order of the emergence, the acceptance, the rejection, perhaps the re-emergence of ideas would be examined, and their interaction, and also the thought of the period in which specific ideas occur in so far as it throws light on their significance. The method should be descriptive and objective, though evaluation will be implied in the record of the fate of ideas, as well as in proportion of treatment.

It is true that much of this material has been and is being dealt with in period histories of Shakespearean criticism. The history by plays, however, proceeding on a different scale, and at right angles, as it were, to the period histories, will not only deal with some of the elements more exhaustively but will or-

ganize them all in a different way, will endeavor to trace period changes in continuity for its own purposes, and will have its own special task to interpret them organically in relation to the single play. It does not need to be said that Shakespeare criticism, national and international, is a highly significant aspect of the history of thought. We believe that it is in relation to the single play that it can, on some sides at least, be most precisely studied.

Ideally the work ought to be kept up to date in future supplements, but to complete it to any definite date would be worth while.

The most economical way to do the work would be to collect the material for all plays simultaneously, since many of the same sources would have to be gone through for all. The difficulties of organizing these labors would be very great. Collaborators would have to keep in touch for purposes of division of labor and exchange of data. Even if the work has to be done a section at a time over a long period, each worker or group of workers will incidentally file much material toward the general project.

While the task as a whole is one for co-operative scholarship, any part of it could if necessary be separately undertaken, such as a history of the scholarship and criticism in the field of *one play*, or one group of plays (say, one tragedy, or the early comedies, or the early histories). This, if well done, ought to be useful even if nothing more came of it.

SPENSER AS AN HISTORIAN IN PROSE

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The points at which the orbits of poetic luminaries intersect are often data of incomparable value; and even the least of them, however unimportant in itself, may enable us to gauge a difference of direction between important bodies. A case of this significant divergence over a small matter might be found, I think, near the beginning of Milton's *History of England* in a passage which treats one of the early British kings:

> Brutus, therefore, surnamed Greenshield, . . . fought a second battle in Henault, with Brunchild, at the mouth of Scaldis, and encamped on the river Hania. Of which our Spencer also thus sings:
>
> Let Scaldis tell, and let tell Hania,
> And let the marsh of Esthambruges tell
> What colour were their waters that same day,
> And all the moor 'twixt Elversham and Dell,
> With blood of Henalois, which therein fell;
> How oft that day did sad Brunchildis see
> The Greenshield dyed in dolorous vermeil, &c.
>
> But Henault, and Brunchild, and Greenshield, seem newer names than for a story pretended thus ancient.[1]

Through his discussion of a rather pale subject Milton clearly, if unemphatically, betrays his attitude toward a predecessor. The reference to "our Spencer" can only be interpreted as a spark of that affectionate enthusiasm which had already warmed such phrases as "our sage and serious poet," "a better teacher than Scotus or Aquinas"; but here, where it is a case of historical and not moral authority, Milton makes it no less evident that he does not follow Spenser's leadership. The *Faerie Queene* is quoted only to be questioned. Milton has glimpsed what Miss Harper was later to demonstrate in detail, that the treatment of historical material in the *Faerie Queene* is astonishingly

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[1] Milton, *Prose Works*, ed. Charles Symmons, London, 1806, IV, 13; *Faerie Queene*, II.x.24.1-7. For an evaluation of Milton as an historian I am indebted to Harry Glicksman, "The Sources of Milton's *History of Britain*", *University of Wisconsin Studies in Language and Literature*, XI (1920), 105-41.

credulous and irrational.[2] Somewhere between the two poets lies the discovery of the modern sense of historical fact.

In defense of both Spenser and Milton it may be urged, of course, that the *Faerie Queene* is poetry, not prose history; that the *History of England* is in every sense prose; and that therefore a divergence of viewpoint between them has no unusual significance. Indeed Milton, although he quotes poetry to illustrate history, must have observed a distinction of this kind for himself; but precisely his ability to draw a line is what makes this slight disagreement with his predecessor significant. Spenser nowhere appears to assume, much less to have consciously decided, that the poetic fancy and the perception of historical fact may belong to organs distinct in quality and frequently opposed in function. His Phantastes is merely a younger Eumnestes, an historian of the future; he describes the chronicles of Fairyland as a companion volume for the chronicles of Britain; and the *Faerie Queene* as a whole profits by a simplification which brings material from the most various sources within the single focus of the poet's fancy.[3] But his failure to develop a distinct sense of historical fact, the short end of the same stick, is more clearly revealed without the guidance of his muse in sober prose.

Spenser's prose dialogue, *A View of the Present State of Ireland,* has promoted a great deal of Irish wrath since its publication in 1633; occasionally the indignation aroused by his proposals to reform the island has taken an easy vengeance by pointing out how vulnerable is his treatise on the side of history. In the seventeenth century John Lynch, for example, comparing Spenser's abhorrence of the Irish mantle with the venerable pedigree he ascribes to it, calls him "the most prejudiced calumniator."[4] But a heavier attack was at the same period delivered by the distinguished Gaelic scholar, Roderic O'Flaherty;

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[2] Carrie A. Harper, *The Sources of British Chronicle History in Spenser's Faerie Queene,* Philadelphia, 1910, *passim.*

[3] *Faerie Queene,* II.ix.47-60. Spenser's failure to distinguish the poetic fancy from the perception of scientific fact may well be connected with the uncertainty whether the muse of the *Faerie Queene* be Clio or Calliope. (Frederick M. Padelford, "The Muse of the *Faerie Queene,*" *SP,* XXVII (1930), 111-24. Josephine W. Bennett, "Spenser's Muse", *JEGP,* XXXI (1932), 200-19).

[4] "Spenserus author est gestatam fuisse pennulam a Judaeis, Chaldaeis, Aegyptiis, Graecis, et Latinis, quae gestatio cum nullam iis barbariae notam inuserit, iniquissimus erit ille rerum aestimator habendus, qui gestationis ejusdem consortio junctos, alios barbarie maculatos, alios immunes pronuntiabit." (*Cambrensis Eversus,* ed. Matthew Kelly, Dublin, 1848-1851, II, 202 and 203) *View,* ed. W. L. Renwick, London, 1934 pp. 66-9.

before the inadvertance of the *View* he exclaims with pedantic glee: "Spectatum admissi risam teneatis amici? . . . We cannot but admire the poet's knowledge in domestic affairs! We are astonished at the politician's puerility in history! So Cicero very justly compares those who are unacquainted with the historical transactions of former ages, to children.—However, it is not my design at present to refute the false and calumnious assertions of this writer."[5]

Before resuming his Irish annals O'Flaherty nevertheless contrives to trip Spenser up on several points in English history. The assertion of the *View* that William the Conqueror introduced Common Law into England is easily overthrown by references to Sleidan and Camden.[6] When Spenser likewise declares that Robert Vere, Earl of Oxford, fled into Ireland during the Barons' Wars and that he was afterwards put to death in England, he merely shows his own incompetence as an historian: the Earl of Oxford never visited Ireland, and he died in exile at Louvain.[7] But the most curious of the errors O'Flaherty has detected occurs in the statement that Edward the fourth sent to Ireland his brother the Duke of Clarence, who married the heiress of Ulster and would have redeemed the island from the re-encroachments of the natives if he had not been recalled to England and there basely murdered; it can be shown that while George Duke of Clarence, the brother of Edward the fourth, served as Lord Lieutenant of Ireland, he neither visited that kingdom nor married the heiress of Ulster; that lady had in fact married his ancestor, Lionel Duke of Clarence.[8]

O'Flaherty, however, fails to call attention to circumstances which both extend and partially explain Spenser's error. We can be sure, in the first place, that by "the Duke of Clarence" he meant George, the brother of Edward the fourth, who was Lord Lieutenant at various times between 1462 and 1477: the *View* dates his supposed deeds after the troubles which Ireland suffered from the enlistment of her landowners in the Wars of the Roses, and the "synister meanes" of his death can only be an

[5] *Ogygia*, trans. Rev. James Hely, Dublin, 1793, II, 285 and 288; for the original Latin see the edition of London, 1685, pp. 367-9.

[6] *View*, ed. Renwick, pp. 6-7 and 252; *Ogygia*, II, 286-7. A failure to read the whole of Camden's explanation may have caused Spenser's mistake. (*Britannia*, London, 1590, pp. 88-9).

[7] *View*, ed. Renwick, pp. 85 and 273; *Ogygia*, II, 286.

[8] *View*, ed. Renwick, pp. 20-1; *Ogygia*, II, 285-8. Ware had already noted the error. (*The Historie of Ireland*, Dublin, 1633, p. 121 of Spenser's *View*).

allusion to the famous malmsey butt.[9] On the other hand, Spenser tells us that his departure from Ireland was followed by an uprising under one of the O'Briens, a certain Murrogh en Ranagh, who devastated large parts of Connaught and Munster; unfortunately the *Four Masters* mention the devastations of Murrogh en Ranagh O'Brien under 1382, and another authority confirms his death in the following year.[10] The muddle of chronology which results can only be explained by interpreting Spenser's Duke as Lionel of Clarence, who married the heiress of Ulster in 1347 and who governed Ireland, for the most part in person, between 1361 and 1366.[11] It is therefore obvious that under the title "Duke of Clarence" two very different noblemen, whose lives were separated by a century of Irish history, have been confused. This mistake, it should be added, was probably supported by a second confusion: the names of three places which the *View* tells us were laid waste by Murrogh en Ranagh O'Brien seem to have come from a document alluding to the devastations made by another Murrogh O'Brien after the death of George of Clarence and in the reign of Edward the fourth.[12] Thus one error is the counterpart of the other.

The double confusion of the two Dukes of Clarence and the two Murrogh O'Briens would not be worth investigating, however, were it merely an anomaly; but it reveals in their most elaborate form the qualities which are typical of Spenser as an historian. His mind, on the one hand, has little or no respect for facts; details of knowledge which should have emerged from Holinshed or Camden, for example the marriage of the heiress of Ulster to a son of Edward the third and not to a brother of Edward the fourth, cause him no uneasiness.[13] With this myopia goes a patrician disregard for numbers: the text of the *View* does not contain a single date, and in almost every passage which involves arithmetic the author's results are an embarrassment to ordinary scholarship. On the other hand, an analogy, a similarity of reference, or the attractive tail feather of a mem-

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[9] *View*, ed. Renwick, pp. 19 and 21; *DNB*, article on George of Clarence by James Tait.

[10] *View*, ed. Renwick, pp. 21-2; *Four Masters*, ed. John O'Donovan, Dublin, 1856, IV, 689 and 691; *Annals of Ulster*, ed. B. MacCarthy, Dublin, 1887-1901, III, 12-3.

[11] *DNB*, article on Lionel of Clarence by T. F. Tout. For his reconquests see Edmund Curtis, "The Viceroyalty of Lionel, Duke of Clarence," *Journal of the Royal Society of Antiquaries of Ireland*, XLVIII (1918), 67.

[12] See "Irish Geography in Spenser's *View*," an article forthcoming in *ELH*.

[13] *Britannia*, pp. 361 and 705.

ory fills him with all the conviction which an historian usually accords to points beyond dispute: the identity of the two Dukes of Clarence could only have been received as truth by a mind trained to seize, not on facts but on resemblances.

Illustrations of the latter tendency are not limited, of course, to the field of English history. Classical literature occasionally furnishes Spenser's historical arguments with a support bewildering to one of his German annotators.[14] His discussion of the mantle, for example, includes the following observation: "The Egyptians lykewise vsed yt as yee maye reade in Herodotus and maye be gathered, by the descryption of *Berenice* in the greeke Comentaries vpon Callymachus."[15] Herodotus, whatever the probability that he might so have written, does not actually write of the Egyptians' using the mantle; the most which can be said for the *View* is that he mentions a similar garment among the Babylonians.[16] But "the descryption of *Berenice* in the greeke Comentaries vpon Callymachus" involves a more interesting error.

The *Hymns* of Callimachus do not allude to any mantle of Berenice, the Queen of Egypt, and his poem on her hair survives only in the Latin translation of Catullus, which is without Greek commentary and contains only a vague reference to clothes (11.80-1). But Spenser's comment, however hopeless it appears at a first glance, may be explained as a confused recollection. The *Hymns* of Callimachus twice call Artemis the "Goddess of the Mantle" and in a third passage describe the mantle itself: "give me to gird me in a tunic with embroidered border reaching to the knee."[17] On the "embroidered border" the Renaissance was familiar with a Greek scholium to the effect that the poet meant a fringe or row of tassels around the mantle and that Homer similarly refers to tassels of solid gold.[18] Furthermore, the passage of Callimachus thus annotated was long ago connected by Upton with Spenser's description of Belphoebe in the *Faerie Queene*, where the skirt of her "silken camus" is said to

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[14] Wilhelm Riedner, *Spensers Belesenheit*, in *Münchner Beiträge zur Romanischen und Englischen Philologie*, XXXVIII, Leipzig, 1908, *passim*.

[15] *View*, ed. Renwick, p. 66.

[16] Riedner, p. 46; *View*, ed. Renwick, pp. 268-9.

[17] *Hymns*, I, 76; III, 225; III, 11-2; for the last the Loeb Classics edition, trans. A. W. Mair, p. 61.

[18] *Hymni*, ed. Henri Estienne, Geneva, 1577, p. 13. For the interpretation of the scholium I am indebted to Dr. W. D. Patton.

have been "hemd with golden fringe."[19] From these circumstances it seems fair to conclude that in the *View* Spenser is referring to a scholium on the robe of Artemis which he had already used in describing Belphoebe; the substitution of Berenice for Artemis is understandable since the same Callimachus had written a well known poem on Berenice; and the mantle of the goddess was the more easily appropriated to the Queen of Egypt since the *View* is bent on proving that the Egyptians, along with other ancient peoples, used the mantle. The same knot of plausible associations, we may observe, has bred fine poetry and false history.

Spenser's failure to criticize the bases of his information frequently appears in a less subjective form, where an error may have been the result of some ordinary oversight, a slip of memory or faulty notes. Along with these there are the more complicated cases in which he pays the penalty for borrowing at second hand. In one passage, for example, he assures us:

> the Gaules (as is stronglie to bee proued by many ancyent and verie athenticall writers) did first inhabite all the sea cost of Spaine even vnto Cales & the mouth of the straightes . . . which appeareth by sundrye cytties and havens in Spaine, called of them, as Portingallia, *Gallecia, Galdunum,* and also by sondrye nacions therein dwellinge, which yet haue reserued there owne names of the *Gaules*: as *the Rhegine Presamarie Tamariti Nerij* and dyverse others. All which Pompeus *Mela*: beinge him self a Spanyard, yet saith to haue discended from the *Colties* of France.[20]

Unfortunately Mela writes only that the Celts occupy the Spanish peninsula and that the Gronii, Presamarci, Tamarici, and Nerii hold subdivisions of it, not that these tribes are descended from the Celts of France.[21] But the origin of Spenser's error is clarified by turning to a passage in George Buchanan's *History of Scotland*:

> Ephorus, according to Strabo, extended the length of Gaul as far as Cadiz; and surely the whole side of Spain which faces north witnesses by the names of its peoples and its nations that it was long ago of Gallic origin . . . . and, if we are to believe Pomponius Mela, a native Spaniard, from the

[19] *Faerie Queene,* II. iii. 26; ed. John Upton, London, 1758, II, 445.
[20] *View,* ed. Renwick, p. 54.
[21] *Chorographia,* lib. III, cap. 1; Riedner, p. 124.

> mouth of the river Douro as far as the cape called either Celticum or Nerium [Finisterre] the Celts dwell under their several cognomens of Gronii, Presamarci, Tamarici, and Nerii.[22]

From Buchanan Spenser has obviously borrowed his reference to Mela and the subdivisions of the Spanish Celts; the surest proof of this is his mistake in crediting Mela with a theory which is properly Buchanan's, that the Spanish Celts are of Gallic origin. In addition to thus trapping himself, he also commits minor blunders. The "Gronii" of his source are transformed into the "Rhegine," perhaps through confusion with the "Regni" later mentioned by the *View*.[23] Pomponius becomes "Pompeus" Mela, a mistake of which something will be said hereafter. And the statement that the Gauls inhabited "all the sea cost of Spaine even vnto Cales & the mouth of the straightes" seems to be an unlucky reminiscence of the two citations by Buchanan, that Gaul extended "as far as Cadiz" and that the Celts dwelt "from the mouth of the river Douro to the cape" of Finisterre. Spenser, in other words, comes off badly from his appeal to the authority of Mela.

On the next page, however, he is not afraid to risk another unlicensed borrowing. This time Tacitus is said to affirm that Spaniards had once settled in southwestern Ireland; but the only relevant passage in the Roman historian is a suggestion that the Iberians may have crossed into south Wales.[24] Ware, the first editor of the *View*, noted the discrepancy and called attention to the following in Buchanan:

> C. Tacitus affirms on sure conjecture, as it seems to him, that the western side of Britain, or Albion, was inhabited by descendants of the Spaniards. It is hardly credible, however, that the Spaniards, leaving behind them Ireland, a country both nearer [home] and of a softer air and soil, should first

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[22] "Ephorus, teste Strabone, Galliae longitudinem ad Gades vsque porrexerit, et certe totum latus Hispaniae ad septentriones versum populorum, et gentium nominibus diu Gallicum testata est originem. . . . et, si Pomponio Melae homini Hispano credimus, a Durij fluminis ostio ad promontorium vsque, quod siue Celticum, siue Nerium vocant, Celtici colunt cognominibus distincti, nempe Gronij, Praesamarci, Tamarici, Nerij." (*Rerum Scoticarum Historia*, Edinburgh, 1583, f. 15r) Fritz Mezger, *Archiv für das Studium der Neueren Sprachen und Literaturen*, CL (1926), 234.

[23] *View*, ed. Renwick, p. 60.

[24] *View*, ed. Renwick, p. 55; *Agricola*, cap. 11.

> have landed in Albion rather than first put ashore in Ireland and thence despatched their settlers into Britain.[25]

That Spenser derived his allusion to Tacitus from this passage is made clear by the peculiar twist of his error. Tacitus suggests that a Spanish people settled in southwestern Britain; Buchanan, using this idea, proposes that they must first have settled in Ireland; and Spenser cites Tacitus (from Buchanan) as his authority for believing that the Spaniards settled in southwestern Ireland. The misconception has a logic of its own.

The discussion of this and the former cases is justified, not so much by their strangeness, however, as by the prevalence of similar errors in the *View*. The historical ineptitude of the dialogue might be illustrated with a hundred details.

Spenser, for example, remarks through Irenius that he has read of no king of all Ireland before Edward le Bruce; but Holinshed makes repeated reference to such monarchs before the Anglo-Norman conquest.[26] When he reports that Caesar will not allow that the bards deliver any truth, Spenser may confuse the bards and druids; yet Caesar does not attack the veracity of the druids either.[27] Spenser says that Buchanan gives above three hundred Gallic names in Scotland; he means about two hundred scattered throughout Europe.[28] His statement that "Ireland is by Dyodorus Siculus, and by Strabo called Bryttania, and a parte of great Bryttaine" has no foundation; in fact the second writer clearly distinguishes between Ireland and Britain.[29] In his account of the battle between Cyrus and Tomyris, Herodotus omits the cries which Spenser finds there.[30] Richard Stanyhurst, the Irish man of letters, is attacked for advancing a theory on the Egyptian colonization of Ireland which he specifically calls in question.[31] The lamentations raised

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[25] "C. Tacitus occidentale latus Britanniae, siue Albij a posteris Hispanorum coli certa, vt ipsi videtur, coniectura affirmat Verisimile autem non est Hispanos relicta a tergo Hibernia terra propiore, et caeli, et soli mitioris, in Albium primum descendisse, sed primum in Hiberniam appulisse, atque inde in Britanniam colonos missos." (*Historia*, f. 15v) *View*, ed. Ware, pp. 122-3; Mezger, p. 234.

[26] *View*, ed. Renwick, p. 22; Raphael Holinshed, *The Chronicles of England, Scotland, and Ireland*, London, 1807-1808, VI, 88-9, 94, 133.

[27] *View*, ed. Renwick, p. 53; ed. Ware, p. 122; *De Bello Gallico*, lib. VI, cap. 13.

[28] *View*, ed. Renwick, p. 59; *Historia*, ff. 18v-20v.

[29] *View*, ed. Renwick, p. 61; Strabo, *Geography*, trans. H. C. Hamilton and W. Falconer, Bohn Library, I, 298-9.

[30] *View*, ed. Renwick, p. 70; Herodotus, *History*, trans. George Rawlinson, London, 1858-1860, Book I, chap. 214.

[31] *View*, ed. Renwick, pp. 71-2 and 270; *TLS*, Correspondence, Oct. 31, 1936.

by the Egyptians at the death of Jacob are misappropriated to Joseph.[32]. Evidence for the nationality of Homer is referred by Spenser to the so-called Plutarchan life of the poet, which is not by Plutarch; the evidence is actually found in the so-called Herodotean life of Homer, which is not by Herodotus.[33] When Spenser attributes to Lucian the information that the Scythians swear by fire and sword which are the powers fitted to work revenge on perjurors, he doubly misinterprets; according to Lucian they swear by wind and sword as the powers which cause life and death.[34] A medieval letter to which the *View* attaches much importance is, through confusion with the heading of another letter encountered in the same manuscript, wrongly said to have been written to the Earl of Shrewsbury rather than the Earl of Rutland.[35] Not Telamon, as Spenser writes, but his son Ajax Telamonius married Tecmissa; and in ascribing a source for the story of Cyrus and the Lydians he confuses Aristotle with Herodotus.[36] He mistakes the meaning of Holinshed and Camden when he writes that Palladius died in Ireland before the arrival of St. Patrick; Camden's correct definition of the Romescot is apparently forgotten when Spenser chooses to redefine it as a rent charged by the Romans for the upkeep of their soldiers; while he obviously follows the account in Holinshed of Alfred's government, he revises the meaning of such terms as *lathe, hundred,* and *wapentake*; for *wapentake,* in turn, he misrecollects the etymology given by Camden.[37]

The list of such errors might be considerably extended, but the enlargement would not alter their significance. They are not errors which can be attributed to the general credulity or ignorance of Renaissance historians, since in the majority of cases Spenser misreads or misremembers the evidence available to his age. The individual points for which the *View* either names or directly imples its sources are about 97 (the count

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[32] *View*, ed. Renwick, pp. 72-3; Genesis, 50.3.

[33] *View*, ed. Renwick, p. 75; ed. Ware, p. 41; Wilhelm Christ, *Geschichte Griechische Literatur*, Nördlingen, 1889, 24; Herodotus, *Opera*, Latin trans. Conrad Heresbach, Cologne, 1537, pp. 273-4.

[34] *View*, ed. Renwick, p. 76; Lucian, *Dialogues*, trans. F. G. Fowler, Oxford, 1905, III, 57.

[35] *View*, ed. Renwick, pp. 83 and 272-3; F. F. Covington, Jr., "Spenser's Use of Irish History in the Veue of the Present State of Ireland," *University of Texas Bulletin, Studies in English*, IV (1924), 11-2.

[36] *View*, ed. Renwick, pp. 89 and 90-1; Herodotus, Book I, chaps. 155-6.

[37] *View*, ed. Renwick, pp. 110, 162, 185-6, and 198-9; Holinshed, VI, 83 and I, 257-9; *Britannia*, pp. 683, 316, and 97-8.

cannot be scientifically fixed); of these points 45, or nearly half, involve crucial mistakes.[38]

Nor is his irresponsibility limited to the use which Spenser makes of bona-fide authorities; he acquires authorities by similar means. In one passage of the *View* he enumerates those writers whom he has found helpful in the study of Irish antiquities: "of the oulder: *Cesar Strabo Tacitus Ptolomie Plinnie,* [Solinus,] *Pompeus Mela & Berosus* of the latter *Vincentius, Aeneas Siluius, Luddus & Buckhanan.*"[39] At a first glance the list is suspect inasmuch as Berosus, Vincent of Beauvais, and Eneo Silvio Piccolomini cannot be said by any stretch of the imagination to have written on Irish antiquities; of those named, in fact, only Humphrey Llwyd and Buchanan had made a special study of the subject; furthermore, we know from another passage that "Pompeus Mela" is not two names but a mistake for that of Pomponius Mela.[40] These problems, however, are clarified when we turn to an antiquarian work by Johannes Boemus, a writer whom Spenser later cites directly; Boemus begins his discussion by specifying as his authorities "Herodotus, Diodorus Siculus, Berosus, Strabo, Solinus, Trogus Pompeius, Ptolemeus, Plinius, Cornelius Tacitus, Dionysius Afer, Pomponius Mela, Caesar, Iosephus: et ex recentioribus nonnulli, Vi[n]centius, Aeneas Syluius," and others.[41] From this passage there can be little doubt that Spenser culled all the names on his own list except Llwyd and Buchanan, the two whose works are really pertinent to the *View*; and the debt to Boemus is corroborated by "Pompeus Mela," the bastard of "Pomponius Mela" and "Trogus Pompeius."—Not that the unacknowledged debt to Boemus was necessarily dishonest from the standpoint of the Renaissance; what it does reveal is Spenser's unusual deficiency in a sense of historical fact.

Overwhelming evidence for such a deficiency exists in the *View*. But if we accept this unavoidable conclusion, we are immediately faced with a paradox: how can a deficient sense of historical fact be reconciled with the reputation which the dia-

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[38] Among the 97 I include a large number of laws, which Spenser reports with more accuracy than any other body of material.

[39] *View*, ed. Renwick, p. 52.

[40] *View*, ed. Renwick, p. 54. see also above. Spenser's reference to Berosus, it is interesting, overlooks Camden's suspicion that the *Chaldaici Antiquitates* were a forgery. (*Britannia*, p. 11).

[41] *Omnium Gentium Mores, Leges et Ritus*, Antwerp, 1571, p. 7; Mezger, pp. 233-4; *View*, ed. Renwick, p. 64.

logue has always enjoyed? In 1598 it was apparently considered for publication; and whatever reasons then interfered, they did not prevent its reproduction in more than a dozen manuscripts.[42] The Carew Papers at Lambeth also contain a set of careful notes made from the *View*; and sometime before 1620 Fynes Moryson studied it as if it were the definitive account of Ireland.[43] When the dialogue finally reached print in 1633, the same editor who pointed out historical errors commended Spenser for "his learning and deepe judgement."[44] Subsequent attacks by native historians like Keating and Lynch and O'Flaherty implicitly recognized that the *View* was an influence in their time; since a second edition appeared in the collected folio of 1679, it has been republished frequently; and today it suffers from no tendency among scholars to depreciate it as an historical document. How then can we reconcile the character of the *View* itself with evidence of its good fame?

In the beginning, if Moryson and the anonymous note-taker of the Carew Papers may be considered typical readers, the *View* served as an authoritative summary of all that was known about contemporary Ireland. On Brehon law, tanistry, kincogish, and a whole body of native institutions; on the galloglas, kern, bards, carrows, landlords, tenants, all the classes of Irish society; on the corruption and incompetence of English officials, high and low; on Tyrone and Feagh MacHugh, rebels of recent memory, and the best plans of campaign against them; on the distribution of permanent garrisons and the apportioning of composition money for their support; on the civil redivision of Irish communities, on the reformation of the Irish church, on the increased powers of the governor; on these and a hundred other issues the *View* offered the most up-to-date and often the most practical information. Even today, although Spenser's material of this kind may now be supplemented and corrected from many other sources, the dialogue retains its value as the most complete picture an Elizabethan has left us of contemporary Ireland; it is, in short, an historical document of the first importance.

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[42] F. I. Carpenter, *A Reference Guide to Edmund Spenser*, Chicago, 1923, p. 206; *View*, ed. Renwick, pp. 305-6.

[43] *TLS*, Correspondence, Feb. 8, 1936; a forthcoming article in PQ on "The Debt of Fynes Moryson to Spenser's *View*."

[44] *View*, ed. Ware, second page of preface.

But this does not mean that Spenser was in any real sense an historian. What he saw around him with his own eyes and gathered from the words of his fellow officials, perhaps just because it filtered through a layer of contemporary prejudice, he reports vigorously and well; what, on the other hand, he read at haphazard and hastily transcribed from the records of the past, he presents without judgment or accuracy. And the distinction between the two sides of the *View*, the contemporary scene and the material which for Spenser belonged to the historical past, is not merely an affair of his relative success in this passage or that: the dialogue itself underlines the difference. Although the discussion of history is widely distributed, the greater part of it appears in the first half of the *View*; when "antiquities," as they are called, are specifically introduced near the beginning, we are told to expect only such as have a bearing on the present customs of the Irish; and at the close the promise of a second dialogue on antiquities alone shows that in his own mind Spenser thought of them as a subject apart from the evils of Elizabethan Ireland.[45] Furthermore, their connection with contemporary customs is stated and repeated rather than proved; with the possible exception of those which support the Tudor claims upon the Irish crown, none of the antiquities are essential to Spenser's real business, the suffering and reformation of the country; some of them, for instance those dealing with the mantle, offset or actually conflict with his picture of a barbarian world; and the deletion of two fairly long historical passages which have survived in single manuscripts confesses the irrelevance of much similar material.[46] We can only conclude, therefore, that the antiquities are a competely separable element, a kind of historical decoration on the façade of the *View*; if they are also flimsy in character, they cause no weakening of its broad and solid structure.

But when these antiquities are finally considered, as they should be, by themselves, where shall we find a key to the interpretation of their flimsiness and their irrelevance? A convenient answer might seem to lie in the haste with which the *View* was obviously thrown together; Spenser must have written at

[45] *View*, ed. Renwick, pp. 48-9 and 219. The distinction occasionally appears in sentences like the following: "All which to rehearse should rather be to Cronicle tymes, then to search into the reformacion of abuses in that realme." (p. 28).

[46] See footnote 4 above. *View*, ed. Ware, p. 121; ed. Renwick, pp. 257-64.

top speed, consulting scanty notes and only a few of the sources he intimates; yet haste will not explain why he should feel it necessary to include material so unripe. The same factor of his individual choice would discredit an explanation based entirely on theories common in his age; it has been suggested that the "probabillitie of thinges" on which the *View* relies for historical evidence is a reflection of the "assensio probabilis" of Jean Bodin; but in that case we may well ask why Spenser chose the "assensio probabilis" and not the "necessaria" and "religiosa," types of evidence which Bodin also recommends.[47] The interpretation merely returns to what is personal in Spenser's mind.

The aspect of his personality with which we have to deal is obliquely discovered, I suggest, by a phrase which the *View* applies to Virgil, that he "was a verie greate Antiquarie."[48] In Spenser's mind the study of antiquities was associated with poetry of a high order, and more or less unconsciously he allows this collocation to govern his treatment of antiquities in prose. If they serve the *View* for not better use than ornament, we may remember that the chronicles of Britain are from the standpoint of logic just as inessential to the *Faerie Queene*; the difference lies in the virtue of poetry, and chiefly Spenser's poetry, to make its ornaments the vehicle of an essential fancy. And so likewise the disregard of fact which nullifies his efforts as a prose historian is only the dark side of his poetic star, the brilliant world of fanciful resemblances, of metaphors and allegories and Florimels both false and true, which beckons to the other stars.

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[47] *View*, ed. Renwick, p. 52; H. S. V. Jones, "Spenser's Defense of Lord Grey," *University of Illinois Studies in Language and Literature*, V (1919), 180 and 204.

[48] *View*, ed. Renwick, p. 66.

PROCEEDINGS OF THE ACADEMY

SIXTY-FIFTH ANNUAL MEETING

The sixty-fifth annual meeting of the Wisconsin Academy of Sciences, Arts and Letters was held, in joint session with the Wisconsin, the Milwaukee and the Northeast Wisconsin Sections of the American Chemical Society, at Beloit College, Beloit, April 12 and 13, 1935. Exactly 173 individuals registered for the two-day session. The meeting was formally opened by an address of welcome by Dr. Irving Maurer, president of Beloit College, after which the following program of fifty-four papers and one public lecture were presented:

Friday morning.—Rufus M. Bagg, A geologist looks at the Hawaiian Islands; Lowell E. Noland, The sponge fisheries of Tarpon Springs, Florida; P. W. Boutwell, S. Pearl Lathrop, a pioneer chemist in Wisconsin; H. A. Schuette, David Boswell Reid, chemist, educator and ventilation engineer; Casimir D. Zdanowicz, The French Academy: 1635-1935; and Silas Evans (introduced by Rufus M. Bagg), Education in sciences vs. the arts.

Friday afternoon, Section A.—L. F. Graber, Some refinements of environmental control in Wisconsin; Eric R. Miller, The droughts in Wisconsin; E. R. Bean, The Mineral resources of Wisconsin; R. R. Shrock and J. H. Havard, Washington Island—its geology and natural history; Loyal Durand, Jr., A farms area map of Wisconsin; Esther Aberdeen, Study of the contact between the Galena and Platteville limestones in southwestern Wisconsin; E. H. Powell (introduced by R. R. Shrock), The chemical composition of the Lodi shale; O. L. Kowalke, An unusual pitting in Niagara limestone; Carl A. Bays, The Mohawkian succession in western Wisconsin; and Alden F. Megrew (introduced by John MacHarg), Mountain climbing in the Zermatt and Chamonix regions of Switzerland and France.

Friday afternoon, Section B.—George W. Woolley (introduced by L. J. Cole), The second stage of the introduction of cattle into Wisconsin; Louis Kahlenberg, A comparison of the relative affinity of different seeds for water; Alfred Senn, The early development of man's vocabulary; John Paul von Grueningen, Professional surgery in Switzerland about 1677. Sidelights from two unfinished manuscripts; O. N. de Weerdt (introduced by P. W. Boutwell), The psychology of special abilities and disabilities; S.R. Ellis (introduced by J. F. Groves), Practical education in Soviet Russia; John B. MacHarg, Leica photography in education; E. Ralph Guentzel, Wisconsin Indian pottery.

Saturday morning, Section D.—Carl Welty and Jean Leland, Eye-reflex experiments with the guppy; Raphael Poepple, Eighty-five genera of protozoa collected from lakes and streams of Fond du Lac County; Arthur D. Hasler (introduced by Chancey Juday), Some digestive enzymes of

Daphnia: A contribution to the physiology of digestion in Plankton Crustacea; Robert W. Pennak (introduced by Chancey Juday), The relation of hydrogen ion concentration to fecundity and length of life in the rotifer, *Euchlanis dilatata*; Herman F. Geske, X-ray studies of the injected circulatory system of the lobster; Sylvia Losey (introduced by L. J. Cole), Attempts to breed the flicker-tail gopher (*Citellus richardsonii*) in captivity; Aldo Leopold, The Chase Journal—an early record of Wisconsin wild life; R. A. Brink, palatability tests with *Melilotus dentatus* (W. K.) Pers; James Johnson, Acquired immunity to plant viruses; Alphonse L. Heun, The cytology of apogamy in *Pteris cretica* var. *Albo-lineata;* Harry V. Truman, Fossil evidence of two prairie invastions of Wisconsin; S. C. Wadmond, Notes on Wisconsin phytogeography (by title); Hilary J. Deason and Ralph Hile, Age and size composition of the commercial stock of Lake Michigan Kiyi (*Leucichthys kiyi* Koelz) populations off Port Washington, Wisconsin, and Manistique, Michigan (by title); Ruth Marshall, Preliminary list of the hydracarina of Wisconsin. V. (by title); Mary Edith Pinney and Janet F. MacNaughton, Some early bird records of Wisconsin and neighboring territory to the west and north (1896-1900) and of Indiana (1876-1877), (by title).

Saturday morning, Section C.—Frederick C. Oppen, The evolution of the vacuum distillation multiple receiver; E. J. Schwoegler, The seed oils of the caprifoliaceae. Preliminary report; Elizabeth M. Smyth and P. W. Wilson, Concerning the alleged fixation of nitrogen by germinating peas; Everett Bowden (introduced by Richard Fischer), Esterolysis of esters; Milford A. Cowley, Levulinic acid. VI. The molecular refractions of several of its alkyl esters; Norris F. Hall, Acidity and relative acid strength; Loren C. Hurd, Rhenium in the qualitative scheme of analysis; R. Benson and H. N. Calderwood, A. chemical examination of the seeds of *Abies balsamea* (L) Miller; N. F. Hall and W. F. Spengeman, Conductimetric titrations in glacial acetic acid; William Krause and Louis Kahlenberg, Palladium-hydrogen; J. L. Oncley (introduced by J. H. Mathews), A study of the Clausius-Mosotti relationship in compressed gases; V. W. Meloche, The determination of magnesium in lake water and its residues; Norris F. Hall and T. O. Jones, The preparation of light water; and Loren C. Hurd, The chemistry of rhenium (by title).

The Friday afternoon sessions closed at four o'clock after which the members of the Academy and their guests assembled in the exhibition room of Theodore Lyman Wright Art Hall to partake of the complimentary tea tendered by the faculty of the College.

The annual business meeting of the Academy was held Friday, April 12, at 5:00 P.M. Nominations for membership from seventeen individuals being presented, the secretary was instructed by unanimous vote to cast the ballot of the Academy in their favor. The list of newly elected members, which includes eight elected on February 1, 1935, by council action, follows: Esther Aberdeen, Milwaukee; Robert J. Barnes, Oshkosh; Carl A. Bays, Webster Grove Mo.; Elliott Rowland Downing, Williams Bay; Loyal Durand, Jr., Madison; Evelyn I. Fernald, Rockford, Ill.; Herman F. Geske,

Milwaukee; E. Ralph Guentzel, Boscobel; Clarence M. Gwin, Saegertown, Pa.; Edward J. Ireland, Madison; Paul B. Jenkins, Williams Bay; Victor Jollos, Madison; John B. MacHarg, Appleton; Irving Maurer, Beloit; Arthur E. Meyer, Rockford, Ill.; M. Starr Nichols, Madison, Frederick C. Oppen, Milwaukee; Raphael Poeppel, Milwaukee; Edward J. Schwoegler, Madison; Warren Strain, La Crosse; Harry V. Truman, Beloit; Carl Welty, Beloit; M. E. Wing, Beloit; Elizabeth Wilson, Appleton, and Fred R. Zimmermann, Chicago. The status of Richard T. Ely was changed from that of annual to corresponding member.

The secretary then presented the following report on membership corrected to date: honorary members, 3; life members, 11; corresponding members, 15; active members, 349; total 378. Membership losses during the year were: deceased, 3; resigned, 3; dropped for non-payment of dues, 16.

The following deaths were reported: George C. Comstock, May 31, 1934; Ernest B. Skinner, April 3, 1935; Gardner P. Stickney, February 25, 1935.

Votes of thanks were tendered the authorities of Beloit College for placing the facilities of the College at the disposal of the Academy, to the members of the faculty for their hospitality, and to the local commitee on arrangements who in no small measure helped make for the success of the meeting.

Resolutions, felicitating the French Academy on the three-hundredth anniversary of its founding and congratulating it not only because of its distinguished record but also because of the notable accomplishments of its members, were passed.

The secretary-treasurer reported informally on the present condition of the Academy's finances stating that the balance in the treasury, after making as advance payment of $762.43 for materials and labor for printing the second half of volume 29 of the *Transactions* is $772.61.

ENDOWMENT FUND

Home Owners Loan Corporation bonds	$1,050.00
Rock County Highway bond	500.00
U. S. Treasury bond	500.00
Commonwealth Telephone Company bonds	400.00
Chapman Block bonds (in default)	400.00
Wisconsin Power and Light Company bonds	200.00
Capitol Square Realty Company bonds	200.00
Cash	114.22
Total	$3,364.22

The annual dinner was held in Emerson Hall with approximately one hundred in attendance. Following this, at eight o'clock, Prof. Norris F. Hall of the University of Wisconsin delivered the annual public lecture at Eaton chapel on the subject "Chemistry Looks at Nature and at Man."

H. A. SCHUETTE,
Secretary-Treasurer

PROCEEDINGS OF THE ACADEMY

SIXTY-SIXTH ANNUAL MEETING

The sixty-sixth annual meeting of the Wisconsin Academy of Sciences, Arts and Letters was held at the University of Wisconsin, Madison, April 17 and 18, 1936, in the Memorial Union Building. Approximately 150 individuals were in attendance. Two general addresses, one by Dr. Joseph Schafer, Superintendent of the State Historical Society, entitled "Professional Farming", and the other by Dr. Rufus Mathew Bagg, the retiring president of the Academy, entitled "Geologic Contributions to Human Progress", and thirty-six papers in ten different fields of interest comprised the scientific program. Entertainment for the ladies consisted of an auto ride around the city, a concert by Mr. W. Norris Wentworth from the University's new Memorial Carrillon Tower and a tea at the home of Prof. and Mrs. H. A. Schuette. The program of papers which were presented follows:

Friday morning.—Eric R. Miller, The solar climate of Madison, Wisconsin; Ernest F. Bean, The state geological surveys of Wisconsin; Ralph Linton, (introduced by H. A. Schuette), New light on aboriginal Wisconsin; H. A. Schuette, the eighty-year research record of the Chemistry Department of the University of Wisconsin.

Friday afternoon.—W H. Twenhofel, The greensands of Wisconsin; Rufus M. Bagg, The record artesian well for Wisconsin; O. L. Kowalke and E. F. Kowalke, The topography of some abandoned beach ridges at Ellison Bay, Wisconsin; Warren Strain, The geography of the northwest dairy region of Wisconsin; Gilbert O. Raasch and Carl A. Bays, Member nomenclature of the Platteville formation of Wisconsin; Russell H. Barker, George Sandy's *Relation*; Julia Grace Wales, A project for a history of Shakespearean criticism by plays; Rudolph B. Gottfried (introduced by Arthur Beatty), Spenser's *View* and essay; Julia Grace Wales, Amleth's shield: a comment on the pictorial elements of the Hamlet story (by title).

Saturday morning, Section A.—Edmund Peracchio and V. W. Meloche, The determination of alkali metals by means of the polarograph; Earl Olson and V. W. Meloche, Oxidation of selenium in the glow discharge; V. L. Potter and C. A. Elvehjem (introduced by W. H. Peterson), A method for the study of tissue oxidations; Don J. Huenink (introduced by H. A. Schuette), On the phosphorus, calcium and magnesium content of honey; Frederick C. Oppen, The viscometric determination of moisture in honey; Louis Kahlenberg, On the function of sterols in plant and animal life (by title); Aldo Leopold, Teaching wild life conservation; A. W. Schorger, The range of the bison in Wisconsin; L. W. Wing and associates (introduced by Aldo Leopold), The winter "die-outs" of 1934-35 and 1935-36; Paul L. Errington, Emergency values of some winter pheasant foods.

Saturday morning, Section B.—John T. Curtis, The germination of seeds by some native Wisconsin Orchids; Vance G. Sprague (introduced by L. F. Graber), Factors influencing the winter survival of plants; O. A. Bushnell and W. B. Sarles, The root nodule bacteria of certain wild leguminous plants of Wisconsin; Norman C. Fassett, Preliminary reports on the flora of Wisconsin. XXV. Arales (by title); Sidney O. Fogelberg, Preliminary reports on the flora of Wisconsin. XXVI. Convolculaceae (by title); H. R. James, Analysis of absorption of radiation by lake waters; William A. Spoor (introduced by Chancey Juday), The age and growth of the suckers of Muskellunge Lake; Robert W. Pennak (introduced by Chancey Juday), A quantitative study of the bottom fauna of some northern Wisconsin lakes; Clarence L. Schloemer (introduced by Chancey Juday), Growth of the muskellunge in various lakes and drainage areas of northern Wisconsin; James R. Neidhoefer, A case of anteversion of the heart of the frog; Paul L. Carroll, S. J., and James R. Neidhoefer, A method of making permanent mounts of celared specimens; Paul J. Carroll, S. J., Reaction of melanophores in tadpoles to theelin; Ruth Marshall, Preliminary list of the Hydracarina of Wisconsin. VI. (by title).

The annual business meeting was held Friday, April 17, at 4:30 P.M. Nominations for membership from twenty-two individuals were presented and the Secretary was instructed by unanimous vote to cast the ballot of the Academy in their favor. The list of the newly elected members follows: Homer Adkins, Madison; Russell H. Barker, Madison; Ralph J. Bushnell, Madison; Grace J. Calder, Milwaukee; Hulsey Cason, Madison; L. E. Cassida, Madison; A. E. Darlow, Madison; Sidney O. Fogelberg, Madison; Glenn Frank, Madison; Oren E. Frazee, LaCrosse; Ray C. Friesner, Indianapolis, Indiana; Alfred Edward A'Courte Hudson, Goldsboro, North Carolina; S. Paul Jones, Waukesha; William S. Middleton, Madison; Mary M. McCalmont, Menomonie; James Russell Neidhoefer, Milwaukee; Fred W. Trezise, Appleton; Arthur H. Uhl, Madison; George Walter Woolley, Madison; Rudolph B. Gottfried, Madison; Frank E. Eggleton, Madison; and Lewis C. Palmer, Madison.

The secretary then presented the following report on membership: honorary members, 3; life members, 11; corresponding members, 16; active members, 342; total, 372. Membership losses during the year were: deceased, 5; resigned, 14; dropped for non-payment of dues, 10.

The following deaths were reported: Charles R. Bardeen, June 12, 1935; R. E. N. Dodge, August 30, 1935; Charles E. Mendenhall, August 18, 1935; Mrs. Arthur C. Neville, July 7, 1935; Aleida Peters, April 6, 1936.

The grant-in-aid of research, which was made possible by an allotment of one hundred dollars from the American Association for the Advancement of Science in lieu of the refund formerly made by it as a credit towards the annual dues of those members of the Academy holding also memberships in the Association, was equally divided between John W. Brooks, a graduate student in the University of Wisconsin, for his studies on the chemistry of the seed oils of the Caprifoliaceae and Prof. Paul L.

Carroll, S. J., of Marquette Univerity for the re-evaluation of the arterial system of the common frog.

Service charges, postage, etc.	
Total	
Balance in treasury	

ENDOWMENT FUND

Home Owners Loan Corporation bonds	$1,050.00
Rock County Highway bond	500.00
U. S. Treasury bond	500.00
Commonwealth Telephone Company bonds	400.00
Chapman Block bonds (in default)	400.00
Wisconsin Power and Light Company bonds	200.00
Capitol Square Realty Company bonds	200.00
Cash	459.09
Total	$3,709.09

The annual dinner was held in Tripp Commons with approximately eighty-five in attendance. Following this, Dr. Glenn Frank, President of the University of Wisconsin, presented a paper entitled "Science and Society."

H. A. SCHUETTE,
Secretary-Treasurer

THE CONSTITUTION OF THE WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS

(January 1, 1937)

ARTICLE I—NAME AND LOCATION

This association shall be known as the Wisconsin Academy of Sciences, Arts and Letters, and shall be located at the city of Madison.

ARTICLE II—OBJECT

The object of the Academy shall be the promotion of sciences, arts and letters in the state of Wisconsin. Among the special objects shall be the publication of the results of investigation and the formation of a library.

ARTICLE III—MEMBERSHIP

The Academy shall include four classes of members, viz.: life members, honorary members, corresponding members and active members, to be elected by ballot.

1. Life members shall be elected on account of special services rendered the Academy. Life membership may also be obtained by the payment of one hundred dollars and election by the Academy. Life members shall be allowed to vote and to hold office.

2. Honorary members shall be elected by the Academy and shall be men who have rendered conspicuous services to science, arts or letters.

3. Corresponding members shall be elected from those who have been active members of the Academy, but who have removed from the state. By special vote of the Academy men of attainments in science or letters may be elected corresponding members. They shall have no vote in the meetings of the Academy.

4. Active members shall be elected by the Academy or by the council, and shall enter upon membership on payment of the first annual dues.

ARTICLE IV—OFFICERS

The officers of the Academy shall be a president, a vice-president for each of the three departments, sciences, arts and letters, a secretary, a librarian, a treasurer, and a custodian. These officers shall be chosen by ballot, on recommendation of the committee on nomination of officers, by the Academy at an annual meeting and shall hold office for three years. Their duties shall be those usually performed by officers thus named in scientific societies. It shall be one of the duties of the president to prepare an address which shall be delivered before the Academy at the annual meeting at which his term of office expires.

Article V—Council

The council of the Academy shall be entrusted with the management of its affairs during the intervals between regular meetings, and shall consist of the president, the three vice-presidents, the secretary, the treasurer, the librarian, and the past presidents who retain their residence in Wisconsin. Three members of the council shall constitute a quorum for the transaction of business, provided the secretary and one of the presiding officers be included in the number.

Article VI—Committees

The standing committees of the Academy shall be a committee on publication, a library committee, and a committee on nomination of members. These committees shall be elected at the annual meeting of the Academy in the same manner as the other officers of the Academy, and shall hold office for the same term.

1. The committee on publication shall consist of the president and secretary and a third member elected by the Academy. They shall determine the matter which shall be printed in the publications of the Academy. They may at their discretion refer papers of a doubtful character to specialists for their opinion as to scientific value and relevancy.

2. The library committee shall consist of five members, of which the librarian shall be *ex officio* chairman, and of which a majority shall not be from the same city.

3. The committee on nomination of members shall consist of five members, one of whom shall be the secretary of the Academy.

Article VIII—Meetings

The annual meeting of the Academy shall be held at such time and place as the council may designate; but all regular meetings for the election of the board of officers shall be held at Madison. Summer field meetings shall be held at such times and places as the Academy or the council may decide. Special meetings may be called by the council.

Article VIII—Publications

The regular publication of the Academy shall be known as its Transactions, and shall include suitable papers, a record of its proceedings, and any other matter pertaining to the Academy. This shall be printed by the state as provided in the statutes of Wisconsin.

Article IX—Amendments

Amendments to this constitution may be made at any annual meeting by a vote of three-fourths of all members present; *provided*, that the amendment has been proposed by five members, and that notice has been sent to all the members at least one month before the meeting.

BY-LAWS OF THE WISCONSIN ACADEMY OF SCIENCES, ARTS AND LETTERS

1. The annual dues shall be two dollars for each active member, to be charged to his account on the first day of January of each year. Five dollars, paid in advance, shall constitute full payment for three years' annual dues.

2. The annual dues shall be remitted for the secretary-treasurer and librarian during their term of office.

3. As soon as possible after January first of each year the secretary-treasurer shall send to members statements of dues payable, and in case of non-payment shall, within the succeeding four months, send a second and, if necessary, a third notice.

4. The secretary-treasurer shall strike from the list of members the names of those who are one year or more in arrears in the payment of their dues, and shall notify such members of this action offering at the same time to reinstate them upon receipt of the dues in arrears plus the dues for the current year.

5. Each member of the Academy shall receive the current issue of the Transactions provided that his dues are paid. Any member in arrears at the time the Transactions are published shall receive his copy as soon as his dues are paid.

6. The fee received from life members shall be set apart as a permanent endowment fund to be invested exclusively in securities which are legal as investments for Wisconsin trust companies or savings banks. The income alone from such fund may be used for the general purposes of the Academy.

7. The secretary-treasurer shall receive annually an allowance of two hundred dollars for services.

8. The secretary-treasurer shall be charged with the special duty of editing and overseeing the publication of the Transactions. In the performance of this duty he shall be advised by the committee on publication.

9. The Transactions shall contain in each volume: (a) a list of the officers of the Academy (b) the minutes of the annual meeting and (c) such papers as are accepted under the provisions of Section 10 of these By-Laws and no others.

10. Papers to be published in the Transactions must be approved as to content and form by the committee on publication. They must represent genuine original contributions to the knowledge of the subject discussed. Preference shall be given to papers of special interest to the State of Wisconsin and to papers presented at a regular meeting of the Academy. The privilege of publishing in the Transactions shall be reserved for the members of the Academy.

11. The Constitution and By-Laws and the names and addresses of the members of the Academy shall be published every third year in the Transactions. The Constitution and By-Laws shall also be available in reprint form from the secretary-treasury at any time.

12. Amendments to these By-Laws may be made at any annual meeting by vote of three-fourths of all the members present.