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JUNIOR ACADEMY
OF SCIENCE ISSUE

WISCONSIN ACADEMY REVIEW



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ATTEND THE 92nd ANNUAL MEETING, MAY 4-6, 1962
 WISCONSIN STATE COLLEGE — LA CROSSE
 General Theme — "Upper Mississippi Valley"

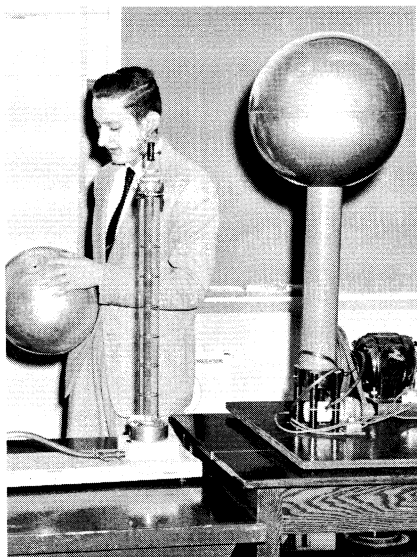


THE THEORY AND APPLICATION OF AN ELECTRON PROTON ELECTROSTATIC LINEAR PARTICLE ACCELERATOR

By Robert Ginskey
Central High School, La Crosse

The high voltage of a home-built Van De Graaff generator is probably best applied to the field of particle acceleration. Because I had such a device, I considered constructing a linear acceleration tube in conjunction with the generator. Prior to actual construction or acquisition of materials, all available sources of information were garnered to ascertain the most economic, yet feasible method of devising my project.

The acceleration tube decided upon was a short length of pyrex tubing mounted vertically in a self-designed and machined piece of yellow brass. The upper portion of the tube containing the irradiating window was also of my own design. The electron emission source was fashioned from a small spiral of nichrome wire found in an old wire wound resistor.



I experimented with several types of low vapor pressure vacuum wax and finally selected a mixture of beeswax and rosin for the majority of my sealing needs throughout my system.

Because I would be working with pressures of less than a micron, I thoroughly examined the characteristics of high vacuum gauges. The McLeod gauge was selected not only because it is a fairly simple device and is relatively accurate, but also because it is inexpensive and can be constructed by amateurs. My gauge, made from a few pieces of capillary tubing, a flask, and a discarded pipette bulb, is entirely self-designed.

Since my accelerator would require a high vacuum of better than .1 micron, an elaborate pumping system was needed. Although commercial pumps capable of vacuums of .01 microns cost well over \$200, my system cost only a

small fraction as much. This was done through utilizing junked refrigerator compressors (\$5.00 each) connected backwards.

Because refrigerator compressors are not designed for vacuum work, certain alterations must be made. If a single stage inlet pressure of lmm. is desired, the bypass line must be sealed, the check valve cut off, and the strainer removed. In my system, an up jet diffusion pump, using butyl phthalate oil, produces the final pressure needed. Thus in my system, the compressors lower the vacuum to approximately 20 microns while the diffusion pump lowers the latter pressure to between .1 and .01 micron. These readings were made by using my McLeod gauge or mercury manometers. In operation, the Van De Graaff generator supplies the power for the acceleration of the particles.

By far the most time consuming aspect of my research was the theory and application techniques of vacuum systems. Because so much time was spent in research and construction, I have not had much time for experimentation.

I plan, however, to extend my study in the future to the development of desirable mutants in edible foods, and the effects of acceleration techniques on petroleum, metals, organic compounds, and food preservation. When these are completed, I intend to alter the polarity of the generator, repeat the experiments using protons, and compare the results with those produced by electrons.

* * * *

CANCER CHEMOTHERAPY

By Sandra Hager
Milwaukee Lutheran High School

The purpose of my project was to test the effect of several chemicals on leukemia. Leukemia is a type of cancer that affects the blood and the blood-forming organs of the body, including the bone marrow. The bone marrow produces the body's blood cells. Ordinarily it makes only as many blood cells as the body needs, but in leukemia the manufacture of the white cells gets out of control and there is a great over-production of them. These white cells don't mature fully and therefore are not able to fight infection as normal white cells do. The number of red cells is reduced and the victim often becomes anemic. In addition, in leukemia just as in

other types of cancer, malignant tumors form in the tissues of the body. These tumors do not have a limiting membrane around them to prevent their spreading. Because this membrane is not present, the tumor invades surrounding tissues, destroying them and often causing death. Leukemia presents an additional problem. Because the tumor is not localized in leukemia, radiation treatment is often ineffective. For this reason I decided to see if I could check leukemia through use of chemicals.

The first chemical I used was hydrogen peroxide. Several years ago, a doctor, while studying cancerous cells, found evidence to make him think that cancer cells are deficient in catalase. Catalase is an enzyme found in plant and animal tissues that frees oxygen by decomposing hydrogen peroxide. He reasoned that if cancer cells do not have enough of this enzyme and can't decompose peroxide, if large amounts of hydrogen peroxide were administered to the patient, the cancer cells, not being able to decompose the peroxide and therefore being sensitive to over-oxidation, should be destroyed without harming the normal cells of the body. He did some work with this idea using various types of cancer, but he did not use leukemia and I became curious to see if his idea would work on it. I therefore decided to see what effect hydrogen peroxide treatment would have in leukemia in mice.

The second chemical I used was cobaltocene. It is an organic form of the mineral cobalt. Cobalt is found in the body's bone marrow where leukemia occurs. It is known to be essential to red blood cell formation, and if an excess of it is present in the body an above average number of red blood cells are produced. I thought that perhaps if more red cells were produced, white cell production might be lowered and the leukemia stopped. I used an organic form of the mineral because organic compounds are usually less irritating to the body than inorganic forms. Cobaltocene is a new cobalt compound, having been developed in the past year. As far as I know, there is no record of its having been used in the treatment of any disease before this time.

I used 24 mice in my experiments, dividing them into four groups of six apiece. I purchased one mouse with leukemia and transplanted the disease to the other 24. This is done by sacrificing the diseased animal, removing the tumor under sterile conditions, cutting the tumor into small pieces, and injecting a piece into each mouse. The first experimental group received a 3% solution of hydrogen peroxide in place of their normal drinking water. The second experimental group received cobaltocene. Since I found no record of its previous use, I

didn't know what dosage would be most effective. Finally I decided upon a solution of one part cobaltocene to 1,000 parts water and gave this to the mice to drink. My first control group received plain water, and the second control group received a chemical called diethylbenzene. I had to use a control that received diethylbenzene because the cobaltocene I received was not in concentrated form but was diluted. Since I wanted to make sure that any results were caused by the cobaltocene rather than the diethylbenzene, I used the second control group. All of the mice received the same diet, and were weighed and checked periodically.

Two weeks after tumor transplantation I took white blood cell counts of several animals in each group. The counts indicated that the controls had a severe case of leukemia, the hydrogen peroxide treated mice had a count bordering on the range between normal and cancerous, and the cobaltocene treated group had a normal count. Twenty-four days after transplantation all of the controls and one-half of the hydrogen peroxide treated mice were dead. To date, the remainder of the hydrogen peroxide treated animals have died while all of those on cobaltocene are alive and well. (It has been 11 weeks since tumor transplantation). Dissection of an animal from each group revealed extensive hemorrhaging and large tumors in the controls, a small tumor in the hydrogen peroxide treated mouse and no tumor in the cobaltocene treated mouse. The mice on hydrogen peroxide treatment experienced unpleasant side effects while those on cobaltocene did not.

In summary, the cobaltocene treatment was very effective while the hydrogen peroxide treatment was not. As a result of my experiments, I am often asked if cobaltocene has possibilities for human cancer. This would of course require much research and experiments, but through my small amount of work with cobaltocene I have not as yet found a reason that would prevent its use in human leukemia and am looking forward to continuing my work with it.

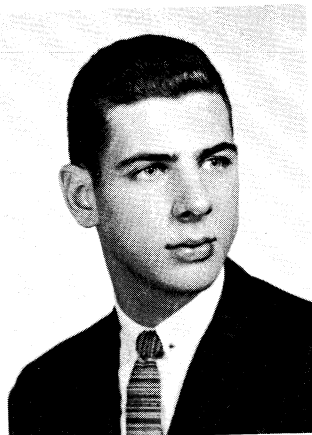
* * * *

EDITOR'S NOTE: The three papers appearing at the beginning of this Junior Academy issue received 1st, 2nd and 3rd place awards respectively at the 1961 State Meeting at Carroll College, Waukesha (see p. 136). On May 12 Miss HAGER was further honored by winning second place in competition sponsored by the American Veterinary Medical Assn. at the national science fair in Kansas City, Mo., where judges described her exhibit as being "well planned and well controlled" and were "greatly impressed with the excellence of the presentation of her results." * * *

POTENTIOMETRIC TITRATIONS IN PHOSPHORUS OXYCHLORIDE

By Mitchell A. Winnik
Nicolet High School, Milwaukee

The high dielectric constant of phosphorus oxychloride makes it theoretically "water-like" in its properties as a solvent, i.e. being the parent solvent of a system of compounds. Such systems in other non-protonic solvents have been studied in detail, and several binary systems in phosphorus oxychloride have been studied. Neutralization reactions have been followed potentiometrically in such non-protonic solvents as nitrosyl chloride and selenium oxychloride. As far as is known, no attempt has been reported to follow neutralization reactions potentiometrically in phosphorus oxychloride.



This paper presents the results obtained in the application of a modified potentiometric technique using concentration cells in the study of neutralization reactions in phosphorus oxychloride. Concentration cells are essential because the nature and properties of phosphorus oxychloride prevent the use of "classical" aqueous reference electrodes with salt bridges; bimetallic systems have not been found which give large enough potential differences to be useful. The present investigation is primarily of exploratory nature, directed toward the development of a satisfactory technique. It is hoped that future studies will be more rigorously quantitative.

Standard Solutions. Molar and saturated solutions were prepared by refluxing weighed amounts with a measured volume of phosphorus oxychloride. All standard solutions were stored in sealed glass ampules. In all operations care was taken to minimize contamination with atmospheric moisture since water reacts with (is a base in) phosphorus oxychloride.

Apparatus. The e.m.f. of the primary cell was measured by means of a conventional circuit employing a Photovolt model 115 pH meter. The primary cell consists of a 100ml. Pyrex beaker closed by a nylon plate in which five openings accommodate the following: a glass tube to admit argon gas (as a means of stirring the solution and a source of the inert atmosphere), a burette, a capillary tube, a General Purpose Beckman platinum or glass elec-

trode adapted to the meter, and a saturated KIO_3 reference electrode. This electrode was a side-arm test tube, the arm drawn out to permit just enough flow of the KIO_3 solution to maintain electrical contact with the primary cell. The system was filled with a saturated solution of KIO_3 in POCl_3 and a Ag AgIO_3 electrode was immersed to within $\frac{1}{2}$ " of the base.

Method. Customary titration procedures were followed. Readings constant to one millivolt were generally obtained after fifteen seconds stirring the solution.

Results. Numerous preliminary relative 'pH' measurements were made employing the glass indicator electrode in conjunction with nine different concentration cell systems both to establish relative acidities and basicities, and to select a suitable reference electrode for the titrations (Tables 1 & 2). Titrations employing both indicator electrodes and the KIO_3 reference electrode have been run. These have shown that phosphorus oxychloride titration curves of satisfactory form and with stoichiometric breaks extending over as much as 0.2 volt could be obtained (Figure 1). Relative strengths of non-protonic acids and bases in phosphorus oxychloride have been determined. In decreasing order the strengths of the acids are: SbCl_5 , SbCl_3 , FeCl_3 , CrCl_3 , AlCl_3 ; and of the bases: quinoline, pyridine, AlCl_3 , PCl_5 , ICl , HgCl_2 .

Both a yellow acidic (pH: 6.0) and a clear basic (pH: 12.0) form of AlCl_3 have been noted. No explanation for the basic form (AlCl_3 is a Lewis acid) is attempted.

This study is based on the Franklin-Germann-Cady acid-base concept* and assumes the ionization of phosphorus oxychloride solvates postulated by Gutmann. He stated the ionization of these solvates in a phosphorus oxychloride solution to be: $\text{X} \cdot \text{POCl}_3 \rightleftharpoons \text{POCl}_2^+ + \text{XCl}^-$ and the complete ionization of phosphorus oxychloride to be: $\text{POCl}_3 \rightleftharpoons \text{POCl}_2^+ + \text{Cl}^- \rightleftharpoons \text{POCl}^{+2} + 2\text{Cl}^- \rightleftharpoons \text{PO}^{+3} + 3\text{Cl}^-$. Therefore, the following substances would in theory be considered acids: POCl_2X , POClX_2 , POX_3 (X is any anion other than a halide); chlorides and electron-pair donors would be considered bases. In the titration of the chromic chloride against the basic aluminum chloride, the complete neutralization reaction is believed to be: $3\text{POCl}_2^+ + 3\text{CrCl}_4^- + \text{Al}^{+3} + 3\text{Cl}^- \rightarrow \text{Al}(\text{CrCl}_4)_3 + 3\text{POCl}_3$. The net reaction would then be: $\text{POCl}_2^+ + \text{Cl}^- \rightarrow \text{POCl}_3$

* - This concept defines an acid as a substance in solution which has ionized so as to liberate the solvent cation; a base would liberate the solvent anion. An acid and a base would react to form a salt and the solvent.

Future titrations will be back-titrated to the equivalence point to isolate the end product, and its percentage composition determined by analysis.

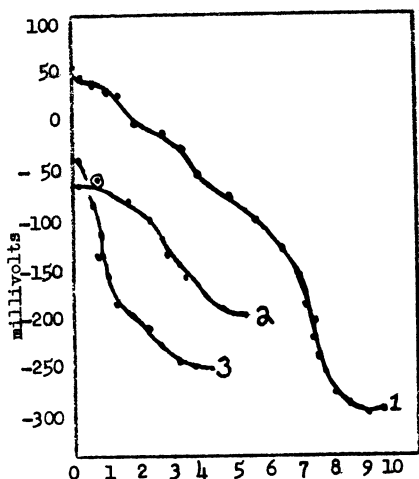
TABLE 1
Concentration Cell Systems
Scale Range Adjustment

System	Scale Range Adjustment	Performance
Sat. HgCl_2 Ag AgCl	full scale	poor e.m.f. differences
Sat. HgCl_2 Pt	pH: 2	none
M/10 HgCl_2 Ag AgCl	full scale	poor e.m.f. differences
M/10 HgCl_2 Pt	pH: 4	none
Sat. KI Pt	pH: 7	none
Sat. KIO ₃ Pt	full scale	poor reproducibility
Sat. KIO ₃ Ag AgIO ₃	full scale	satisfactory
Sat. K ₂ CrO ₄ Pt	full scale	K ₂ CrO ₄ contamination
Sat. MgO Pt	no reading	none

TABLE 2
Relative 'pH'

System: glass sol'n	HgCl ₂	Ag	AgCl	System: glass sol'n	KIO ₃	Ag	AgIO ₃
Solution	pH			Solution	pH		
Phosphorus oxychloride	7.0			Phosphorus oxychloride	7.0		
M/10 HgCl_2	6.8			M/10 Quinoline	13.2		
Sat. KIO ₃	7.2			M/10 Pyridine	13.0		
Sat. K ₂ CrO ₄	7.5			M/10 AlCl ₃	12.0		
M/10 PCl_5	7.2			M/10 PCl_3	9.6		
M/10 AlCl ₃	6.8			M/10 ICl ₅	8.9		
				M/10 HgCl_2	7.5		
				Sat. KIO ₃	7.0		
				M/10 AlCl ₃	6.2		
				M/10 CrCl ₃	6.0		
				M/10 FeCl ₃	4.3		
				M/10 SbCl ₃	1.2		
				M/10 SbCl ₅	0.4		

7.0 is assumed standard
in both systems



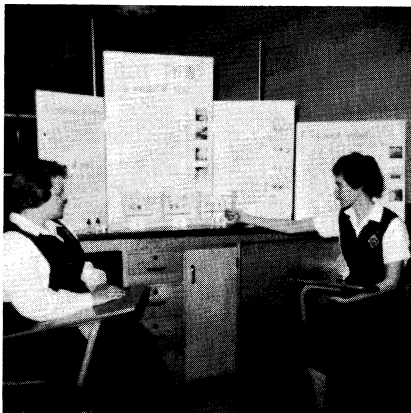
milliliters of acid

1. AlCl_3 vs. CrCl_3
2. PCl_5 vs. SbCl_3
3. PCl_5 vs. SbCl_5

Figure 1. Potentiometric titration curves in phosphorus oxychloride

BLOOD TYPING

By Elizabeth Konkol and Audrey Guzman
Maria High School, Stevens Point



Our project, "Blood Typing," has a two-fold purpose: first, to prove that blood typing can be performed if no hospital is available and with the use of limited supplies, such as can be found in retail stores or in our own homes; secondly, to determine the ratio of the four blood types among the seniors of our school and compare it with the national scale.

In order to proceed with our project it was necessary to obtain our essential supplies. Serum, the liquid determiner of types, was secured through two volunteers, one having Type A blood and the other Type B blood. Each donated sixty milliliters

of their blood which was centrifuged to separate the serum from the blood. Experimenting with several types of paper we determined a 3x5 inch file card as being the best substitute for the regular glass slide used in hospitals on which to actually perform the reaction. However, through experimental work we discovered no reaction could take place because the card absorbed the serum and blood. The card also wrinkled. To prevent this we decided to spray our cards with some sort of clear lacquer spray. We experimented with moth spray, perfume spray, air deodorant, plastic colorless lacquer spray, and a dermatoplast spray. The dermatoplast spray proved to be the most effective.

On the sprayed and labeled card we placed a drop of A serum on the marked anti-b side and a drop of B serum on the marked anti-a side. After wiping the girl's little finger clean with alcohol we pierced it with a lancet. We could have used a sterilized pin for the piercing, but instead purchased a lancet for each girl so as to prevent the possibility of spreading bacteria. Then we held the girl's finger in such a position that we could place two drops of blood on each drop of serum. With a separate toothpick for each serum drop we mixed the serum with the unknown blood type, rotated and tilted the card approximately ten minutes to enable the serum and unknown blood cells to combine and observed the following reactions:

If the unknown blood reacted with known Type A blood's serum, the unknown blood was Type B. If the unknown blood reacted with known Type B blood's serum, the unknown blood was Type A. If the unknown blood reacted with both known Type A and B blood's serum, the unknown blood was Type AB. If the unknown blood did not react with either Type A or B blood's serum, the unknown blood was Type O. The following chart helps to explain this better by including the theory of antibodies.

anti-a	⊗	○	⊗	○
anti-b	○	⊗	⊗	○
Type	A	B	AB	O

During the typing process we observed that all blood did not react the same with a given amount of serum; some reacted readily but weakly, some readily and strongly, others slowly and weakly, and still others slowly but strongly. This alerted us to the possibility of subgroups among the four main groups, A, B, AB, and O. We also noticed that the smaller the amount of blood compared to a large amount of serum, the better the reaction. Since our reactions were slow in comparison to the serum used at the hospital for our demonstration, we felt that our serum was not potent enough in antibodies, and therefore, were made aware of the fact that the potency of serum affects the rate of reaction.

The ratio of the blood types determined from among our 60 fellow-seniors deviated only slightly from the national scale as indicated below:

Type	O	A	B	AB
Fellow-Seniors' Ratio	33.8%	45.7%	15.4%	5.1%
National Ratio	45.0%	41.0%	10.0%	4.0%

As is evident from the above result, our main purpose for our project was achieved--we are convinced that blood types can be found without the use of a hospital. Extreme caution, however, must be taken so as not to allow for the possibility of carrying or transferring bacteria.

* * * *

THE DEGENERATION AND MUTATION OF E. COLI BY ELECTRICITY

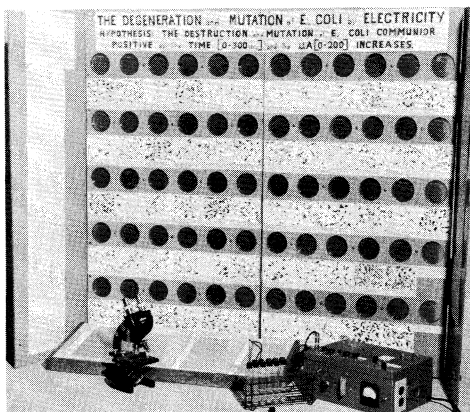
By John Charles Schaefer
North High School, Sheboygan

It is the purpose of this project to show the effect of 0-200 microamperes on a suspension of 4.0×10^7 E. Coli Communion per ml when the time of exposure is varied from 0-300 seconds. Working with these two different variables, my first step was to obtain a pure culture of E. Coli Communion. After subculturing seven times, I had a pure culture. This step was followed by the building of EBE (Experimental Bacteriological Electrifier).

After the various meter shunts were arranged on EBE, I next made a suspension of E. Coli Communion with distilled water. I put 10ml of the suspension in each of the 96 sterilized vials. With this step completed, the electrification process started. The microamperes were varied every 25 microamperes and the time every 30 seconds. Controls were set up through the experiment so that there would be some way to compare the electrified bacteria to the normal bacteria. All adjustments were made beforehand.

After the E. Coli Communion were subjected to the electricity, I made pour and streak plates. Comparing the electrified E. Coli to the normal E. Coli, I plotted the growth and also compared the size of the colonies. Microphotographs were also taken from both streak and pour plates. The higher the exposure and the higher the microamperes, the smaller the colonies were, the less growth there was, and the smaller the rods were microscopically. However, the gram negative rods returned to normal size after five sub-culturings.





Supplementary experiments were also run which included the carbohydrates, litmus lactose agar test, starch hydrolysis, nitrate tests, hydrogen sulfide test, IMViC, Gelatin test, Milk test, thermal death point, thermal death time, and motility tests.

In the carbohydrate tests there was a decrease in gas production in dextrose, lactose, and sucrose as the microamperes and time increased. However, no gas was produced in maltose except in the control tubes which received inoculum that was not subjected to any electricity.

There was a decrease in gas production in litmus lactose agar, nitrates were not as easily reduced to nitrites, there was less acid and curdling in litmus milk, and the less motile the E. Coli Communiior became as the time and the microamperes increased. The IMViC, gelatin tests, starch hydrolysis, thermal death point, and thermal death time did not change.

Thus, I have come to the conclusion that 0-200 microamperes has a degenerating and mutating effect on E. Coli Communiior. This effect is most pronounced as the time and microamperes increases.

Because of the degenerating effect of electricity on the bacteria, perhaps it could be used to sterilize media. Since E. Coli Communiior (400,000 per ml) were killed completely at 200 microamperes when the time was 30 seconds, media might be sterilized by such a system. Milk could also be sterilized in such a manner. Since sea water can be converted into fresh water by running an electric current through a solution of salt water, thus separating the Na^+ and Cl^- ions from the water, the bacteria would also be killed at the same time. This would reduce the amount of filtration and chlorine that have to be added to make the water safe to drink.

In the future, I hope to continue this project and go into the fields of antigenic makeup, resistance to different anti-septics, and to conduct more quantitative analysis experiments along the fermentation line so that I will be able to pinpoint the mutations that are being caused by the electricity.

* * * *



EFFECT OF THE MALE SEX HORMONE ON FEMALE CHICKENS

By Patricia Bauman
Maria High School, Stevens Point

My decision to work with female chickens and the male sex hormone arose from my reading about the use of hormones in medicine. On February 20 I purchased guaranteed sexed chickens, 12 day-old females and six males for controls. Six of the females were also kept as controls. The other six females were divided into three groups: A, B, and C. On February 27, when they were a week old, I started the injections of the three groups of females with Oreton, an aqueous suspension of testosterone, the male sex hormone, which I obtained from the Schering Corporation. I used a tuberculin syringe with a 24 gauge needle. The A birds received 0.10 ml., the B birds 0.15 ml., and the C birds 0.20 ml.. During the entire experiment I gave 113 injections in all.

By March 4 I observed combs and wattles on the A, B, and C birds. The most prominent were those of the C chickens which had been injected with the greatest amount of Oreton. Those of the B chickens were less prominent and those of the A birds were the least developed. None of these characteristics were noticeable on the normal males as yet. One of the C birds was even crowing at this time. By March 6 both of the C birds crowed.



Effect of Male Sex Hormone on Female Chickens - Bird at left (with large comb and wattles) has been injected regularly with the male sex hormone. Bird at right (with small comb and wattles) is a normal male.

By March 16 the B and C chickens had very well-developed fiery red combs and wattles and the B birds were also crowing. Up to this time the C birds had always been more developed than the B birds. Now the B and C birds looked very similar. In fact, by April 1 a B chicken surpassed the C birds in external male characteristics. One of the C birds was very aggressive and belligerent, having bitten me many times. The C birds, being more developed, used the most water and feed; the A birds the least. Also about March 16 the normal males started to develop combs. These were very light pink and very small. After chloroforming three chickens, one normal female, one normal male and one C bird, my biology instructor, a classmate and I dissected them. I removed the sex organs and Dr. Grinvalsky, the pathologist of our local hospital, made slides of them. The results were:

1. The ovary of the normal female contained numerous circular structures called follicles, the sites of future eggs.
2. The testis of the normal male contained seminiferous tubules.
3. The sex organ of the female injected with Oreton resembled that of the male in two ways: a. The external appearance of the organ was more like a testis than an ovary; b. The organ contained seminiferous tubules rather than the circular structures of an ovary.

I wondered what would occur if I discontinued the injections. One of the B birds had an inflammation in the region of the breast bone, so I stopped injecting it on March 27. By April 8 there was a great change. The wattles and combs were almost gone; what remained had faded to a faint pink. Before this they had been as red and prominent as those on the other injected birds. On April 27 I dissected this bird and Dr. Grinvalsky made a slide of the sex organ I removed. The results were:

1. The sex organ contained numerous follicles which were identical to those which I observed in the normal ovary.
2. I also noted a small remnant of the male counterpart remaining.

In the normal female ovary there is a male counterpart, a remnant of the male sex organ. In natural development the ovary matures and this remnant never begins to grow.

I concluded that by my experimental procedure I had stimulated the male sex organ remnant, enabling it to overpower the ovary and to mature. Also, by discontinuing the injections of Oreton a definite regression was caused in the sex organ as well as in the external characteristics.

* * * *

ACKNOWLEDGMENTS - Photos: p. 107, courtesy Stevens Point Journal; p. 136, Henry Alstrup, Carroll College Publicity Dept.; from Wis. Alumnus, July 1961, Reynolds and Hougren on p. 141, Roark, p. 142, Schmidt, p. 143; p. 141, Trenk from UW Photo Lab.; p. 142, McElvain, UW Ext. Div. Dept. of Photography; p. 144, Marquette Univ. News Service. Sketches: p. 119, Wis. Hist. Coll., vol. VI; p. 129, What's New in Farm Science, July 1958. Maps: p. 120-121, Travels Through the Interior Parts of North-America in the Years 1766, 1767, and 1768, by J. Carver (1779); p. 139, New Laws for New Forests by Erling D. Solberg, with copyrighter's permission.

RESPONSE OF BABY CHICKS TO TESTOSTERONE

By David Logerquist
Sevastopol High School

Endocrinology is the study of the ductless glands. These organs produce chemical substances called hormones which greatly affect various regions of the body where the substances are carried in the blood stream. It certainly is an interesting division of science and it presents unending possibilities as far as research problems and experimentation are concerned.

Last year I did my first work in this field. The hormones used were pregnant mare serum (PMS) and propyl-thiouracil. PMS is a follicle stimulating hormone and the thiouracil is a thyroid extract which generally causes the formation of a goiter.

During the past summer I attended Morehead State College in Morehead, Kentucky on a National Science Foundation scholarship. This enabled me to continue my research. Due to the fact that better facilities were available, my experimentation was highly successful. One of my professors had worked in the field of endocrinology, and this too helped me a great deal.

In this, my second experiment, I used 30 chicks which were the same age and breed as those in my first (Single comb White Leghorns). However, I used Testosterone, the male hormone. I injected 0.1cc of the solution into each of the 15 test chicks daily for eight days. I was truly amazed at the distinct external variations between the test chicks and the controls. The injected chicks were far ahead of the others in sexual development. Because of the time factor I was not able to make complete studies of the internal changes which took place in the chicks.



Upon returning to high school this past fall I was still extremely interested in my work with the chicks. In the third experiment I used 40 chicks (10 pullets and 30 cockerels), again the same age and breed as before. The hormone used was Testosterone.

In this experiment I varied the concentrations which were administered to the chicks for the purpose of determining the breaking off point of effectiveness. In order to do this I divided the chicks into four groups: 1 control, 1 25mg. per cc., 1 50mg. per cc., and 1 75mg. per cc., each containing 10 chicks. The criteria for sexual development were as follows: Body weight, Testes and ovaries development, Comb growth, and Wattle growth. The injections were carried out over an eight-day period. Five chicks from each group were weighed daily and their average gains were computed. After the third or fourth day it was evident that the chicks in the 25mg. and 50mg. groups had combs which were more highly developed than the others. The wattles also were showing signs of increased development. The aggressiveness of the chicks in those two groups was equally significant. And above all, the weight gains being made by those chicks was steadily moving ahead of the gains made by the controls and the 75mg. chicks. The chicks in the 75mg. group did not show any signs of increased sexual development either. Things continued along these lines for the duration of the experiment. I was able to conclude that the maximum response in this experiment was at 50mg. concentration. My attempt to determine a breaking off point was also successful. It appeared to be between 25mg. and 75mg.

I definitely plan to continue this work. One of the things I intend to do is to demonstrate the effect of Testosterone on bone marrow, when used in the treatment of certain diseases. I would also like to probe to a greater extent into the basic endocrine structure of the animals with which I work. I intend to apply all of the knowledge and experience which I have gained to make my future research as conclusive and as valuable as possible. The work which I have done in endocrinology has helped to train me in the technique of thinking. Through it I have come to realize the merit of ideas leading to research. The results of this research lead to further ideas for future research. This is and has been for all time the pattern of obtained knowledge.

* * * *

UTILIZATION OF THE CORNSTALK

By Donna Montieth
Richland Center High School

The most important thing we can do today is to make the best use of what we have. Although the cornstalk contains a ready supply of cellulose it is often regarded as a waste and simply discarded.

Cellulose fibers are cemented together in the natural state by lignin. In order to utilize the cellulose of the cornstalk it is first necessary to remove this compound. This was done by cooking the pith and endodermis of the shredded stalk in a 30% solution of NaOH for three or four hours at a temperature of 140°C, after which the stalks are thoroughly rinsed. This cellulose is defibered in a beater for 30 minutes. The pulp is then rinsed and pressed to remove excess water. It is stored in this condition in a closed container.

To make paper the pulp is placed in water to form a suspension. The mold, which consists of a frame over which nylon is tightly stretched, is placed on a flat surface. The suspension is then poured through the mold and the water allowed to drain off leaving a thin film of cellulose in the mold. The paper is dried, removed from the mold and pressed with a hot iron. By regulation of time of cooking, beating and the amount of pulp used, any grade of paper from very fine parchment to heavy fiberboard may be made.



I was able to make rayon by a process which is very similar to the commercial viscose process. The bleached pulp is soaked in a 40% NaOH solution for 20 days, removed and pressed to eliminate as much NaOH as possible. This cellulose is submerged in CS_2 for 24 hours in which an orange compound cellulose xanthate is formed. Excess CS_2 is removed by evaporation. The cellulose xanthate is finely divided and dissolved in a 5% solution of NaOH for eight hours. Rayon is made by forcing the viscose through a capillary tube into a hardening bath of $(2,7) H_2SO_4$.

I have also worked with the cuprammonium process of making rayon. $Cu(OH)_2$ is dissolved in a 30% NH_4OH solution. These two compounds combine to form a complex deep-blue compound, Schweitzer's reagent, which dissolves cellulose. I added dried pulp until the completely dissolved pulp formed a syrupy liquid. This liquid is then forced through a small opening into a hardening bath of $(1,20) H_2SO_4$.

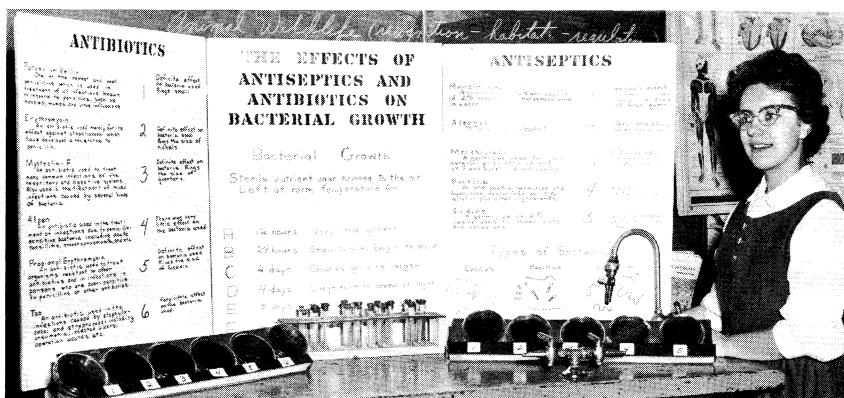
I am working with this cellulose in an attempt to make cellulose nitrate. Cellulose nitrate dissolves in acetone or a mixture of ether and alcohol, and with camphor as a plastizer forms celluloid. As yet I have been unable to achieve the degree of nitration required to make the nitro-cellulose soluble. My threads are quite brittle and break easily. I am attempting to improve the strength of the threads by modifying my processes. I also plan to continue working with cellulose, deriving organic plastics from it.

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THE EFFECTS OF ANTIBIOTICS AND ANTISEPTICS ON BACTERIAL GROWTH

By Marie Hoff
Sparta High School

The idea for my project began one day last fall when my brother fell and skinned his knees. I washed the abrasions with soap and water as learned in Red Cross First Aid Course, then finished the job with antiseptic and some bandages from the medicine chest. When putting the things away, I noticed the other bottles of antiseptic and read their labels. I thought it would be interesting to see just how effective these various antiseptics were in killing the bacteria that cause infection in wounds.



Through research, I found that bacteria could be grown on which to test the antiseptics. Our local druggist had no agar, but seemed interested in my idea. He suggested that I also try to determine the effectiveness of some various antibiotics and gave me several samples.

I successfully prepared and sterilized a quantity of agar. Using a pair of kitchen tongs, I held the sterilized test tubes over the flame of the gas burner and poured some agar solution into each tube, then propped them up on a book to produce a slanted surface. After about an hour, the agar had solidified to a form much like Jello. I opened the tubes and exposed them to the air for 15 minutes, then sealed them and left them at room temperature to grow. The growth began before 24 hours were up and by five and six days the surfaces of the slants were covered with bacterial growth. I put them in the refrigerator to keep the growth at this point. The dishes used were boiled and washed in hot soapy water. Since I had obtained this bacterial growth from the air in our home, I wondered if there was a chance of getting any disease from this growing bacteria. Growth was very concentrated, compared to the amount of bacteria in the air. Reading more, I found that few pathogenic, or disease-causing bacteria, live long outside the body and that few grow easily at room temperature.

The answers to my many questions were not in the few books I had access to, so I went to visit the medical technology laboratory at St. Mary's Hospital. The Sister and technician were wonderfully willing to help. They showed me the blood agar slants they use in such tests and gave me a small quantity of blood to try. My plans were to have a Petri dish for each agent that I was to test, but the small amount of blood was not enough. Finding I could not buy any blood, I resorted to the only thing red I had available, red food coloring.

I sterilized the agar as before in the pressure cooker and poured some solution in each of the sterilized Petri dishes. Using a sterile cotton swab, I swabbed some growth from one of the tubes of the first experiment and began to inoculate the cultures. Using a drinking glass for each agent, I put an eyedropperful of each antiseptic in a glass. Putting an equal amount of water in each of the others, I dissolved previously weighed amounts of antibiotic in each. Small circles of blotting paper were soaked in these. With a tweezers, I arranged four circles from each glass into a Petri dish. Now to wait for them to grow.

Now I wondered which type of bacteria I could determine of that planted from the test tube into Petri dishes. I prepared several slides, using a Mythelene blue stain. Under my own microscope, I classified it as a cocci. Under the more powerful one at the hospital, the slides revealed a mixture of cocci and bacilli.

From the start of growth in the Petri dishes, I could see circles around the disks where bacteria didn't grow. As the bacteria grew, the circles became much plainer and one could definitely see the effect of the antiseptic or antibiotic. If the circle was small and close to the disk, the agent was not very effective; but if the circles were wide, I drew the conclusion the agent was more effective. Of the common antiseptics I used--mercurochrome, alcohol, bactine, merthiolate and iodine--merthiolate proved to be the most effective, while bactine was least effective. The antibiotics used included Potassium Veillin, Ethromycin, Mysteclin F, Alpen, Propionyl Ethromycin and Tao. Mysteclin F seemed to be the most effective, while Alpen was least effective.

I found that I could grow bacteria and could test the effects of various agents on it. I found that I could substitute red food coloring for the blood in the agar cultures.

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COSMETICS WITH MINK OIL

By Nancy Linzmaier

Columbus High School, Marshfield

Every fall when my father, a mink rancher, fleshes his mink pelts, his hands become soft and smooth from the mink fat. This gave me the idea to use mink oil in making cosmetics. But I could find no formulas for cosmetics using mink oil, so I had to make my own or substitute mink oil in the ones I did use. I also had to reduce the quantity of the materials needed to satisfy the size of my samples. Altogether I made 20 samples.

My first sample was a hand whitening lotion made by adding hydrogen peroxide to mink oil in a 1:2 proportion followed by rapid chilling of the mixture and then whipping it to the desired consistency. The addition of perfume was the last step. I made three other preparations for hand use: a pink milky lotion, a



GREASY COLD CREAM

T.M. 1 lb.
MUNGSEARATE 2 lb.
3 lb.
10 lb.

GREASY COLD CREAM

MINK OIL 12 oz.
BEEWAX 25 oz.
HEAT AND ADD BOILING
BORAX 1/2 oz. AND WATER 8 oz.
STIR RAPIDLY
PERFUME

cooling hand lotion, and a hand salve. For the salve, lanolin and petrolatum were macerated together with a fork before being added to a hot boric acid mink oil mixture. The end product was slightly yellow in color. By stirring a measured quantity of witch hazel into a mink oil-glycerol monostearate-lanolin mixture, which had been heated together until clear, I obtained a milky lotion. This was colored pink with vegetable dye and scented. But for the cooling hand lotion, I used a

green vegetable dye and made the sample by adding the required amount of mentholated alcohol and glycerine to heated mink oil.

From cosmetics for the hands I went to cosmetics for the face. However, I confined myself to two kinds of cold cream: a greasy variety and a non-greasy type. The non-greasy kind was made by heating paraffin, petrolatum, glycerol monostearate and mink oil in an aluminum double boiler until it became a uniform mixture. By adding 10 oz. of boiling water, with continual stirring, to the mixture, it became smooth and creamy. Here again perfume completed the process. For the greasy cold cream sample I used beeswax with mink oil to which I added a boiling borax solution with vigorous stirring. The mixture was scented after cooling.

Of all the cosmetics I made, the procedure for my cleansing cream was the simplest. It came from an approximate 2:1:1 proportion of mink oil, paraffin and petrolatum heated together and whipped and then scented.

I also made three samples of cosmetics for men: shaving cream, pre-electric shaving preparation and an after shaving lotion. The shaving cream was the brushless variety made from equal amounts of mink oil and glycerol monostearate and the addition of two and a half times as much boiling water with stirring. Perfume was added at this point. The pre-electric shave sample is actually a hair stiffener. It was prepared from a 1:1 alcohol and water mixture complemented with a little aluminum chloride and a trace of mink oil and toned up with green vegetable dye and perfume. My after shave lotion has a cooling effect due to the menthol, alcohol and witch hazel in it, while the trace of mink oil gives it a smooth feel.

No cosmetic collection would be complete without soap. Mine has three kinds: face soap, bath soap, and bubble bath. The soap making included dissolving 13 oz. of caustic potash in 1½ pints of water in a stone crock. When this was cooled slightly, 1½ cups of mink oil were added with slow stirring until the mixture reached the consistency of honey. I divided this supply into several portions to make variations: Portion 1 had borax added for a little bleaching action. Some of the resulting soap bars were colored pink or yellow. Portion 2 was whipped to add air and produce a floating soap. Color was also added. Portion 3 was poured into a bath bar sized mold. All soap samples were allowed to stand near an open container of perfume for 14 days. Portion 1 was next chipped up and dried in a 275° oven to make it brittle; addition of perfume and pulverizing followed. Result: bubble bath, pink and yellow. Three samples of shampoo--clear, lotion and cream--were obtained from uncolored Portion 1 soap. Only the cream type required beating after dissolving the soap in hot water.

For my lotion deodorant, zinc oxide, paraffin and boric acid in weighed amounts were included with mink oil, then thinned with water and finally colored and scented. With less water, I obtained the cream sample. My own formula for stick deodorant was melting together mink oil and paraffin in a 2:1 ratio, requiring a heavier perfume and molding in a tubular cardboard mold.

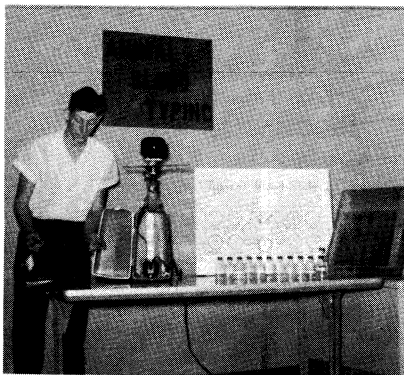
My lipstick sample was made by melting together stearic acid, beeswax, paraffin, mink oil and lanolin. The dye was an eosin alcohol preparation dispersed in stearic acid for easy addition. Varying eosin content resulted in different shades of red. From my project I learned how easily cosmetics can be made and found that mink oil can be used satisfactorily; also, mine cost less.

ANIMAL BLOOD TYPING

By Donald Bird
Richland Center High School

Animal blood typing is a comparatively new field. The typing serum cannot be purchased so I made my own typing reagents from a formula received from the University of California, School of Veterinary Medicine.

When I set about to make my typing reagents, I collected all the legume seeds available, which were then ground or pulverized. To each of these leguminous powders I added by equal volume a 1% salt solution. Letting this stand overnight, I pressed the extract from the pulverized legume seeds. Again I would add by equal volume a 1% salt solution. After letting it stand three hours, I put it in the centrifuge. The extract going to the top was saved and used as the typing reagent.



In preparing my slides, I would first draw the wax rings. Then I would draw the blood from the animal and mix it with an iso-tonic citrate blood anti-coagulant solution (2% sodium citrate and .5% sodium chloride). I corresponded my typing reagents by number to a certain wax ring on the slide. I did it by number because I didn't have any way of putting the correct alphabetical system on my blood types. I would apply a drop of the typing reagent to the designated ring and add a drop of blood. This I would stir with a toothpick. By stirring, the blood would agglutinate faster if it was going to. If the blood agglutinated in one of the wax rings (any of the wax rings), then that was the animal's type of blood.

By my system of blood typing, animals of different species could have the same blood type, but it is rare in the same species. For example, cattle have the possibility of having 50 million different blood types.

From typing 19 examples, including cold blooded animals, fowl, and cattle, I found that the typing reagents, green bean no. 2 and cardinal climbing flowered bean no. 5 were the most common. The most rare of the typing reagents was no. 9, the sweet clover extract.

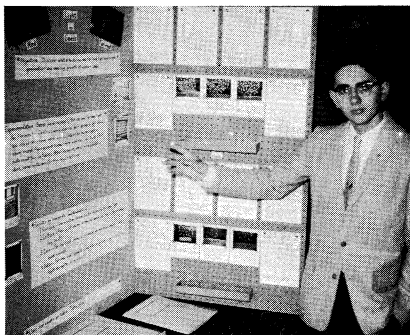
Blood typing is very improbable for transfusions because there are so many types. Instead, it is carried out mainly for hereditarial purposes for Purebred Dairy Associations, and on poultry farms it is used to produce a better line of laying hens.

Since animal blood typing is of very recent years, it has not been too well adopted yet, but present statistics show it to be of major importance in future years.

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LIGHT FOR SURVIVAL

By Leonard P. Iaquina
Mary D. Bradford High School, Kenosha



Providing food for the world's population will depend on finding new sources of food and making present food supplies more productive. Research on the latter in connection with photoperiodism has been in progress only several years. With it as a basis, I set up experiments in the division of this field concerned with the color of light and its effect on photochrome, a photoperiodic chemical. My objective was to determine what effects red (6500 Å) and far-red (7300 Å)

light have on the germination and seedling growth of seeds.

This is the procedure I followed. Sunflower, lettuce, corn, and oat seeds were tested. Lettuce seeds were germinated on brown toweling paper and the other seeds on light green flannel after being exposed to the proper radiation. One hundred seed lots were tested. I used two groups of experiments. In Group A individual experiments were run on each seed type. Each experiment was divided into a control, red, and far-red group and seeds were allowed to germinate for three days after exposure. Group B trials consisted of Group A experiments run continuously for one week. Thus, seeds were examined from 24 to 168 hours after they were exposed. Seventy-three individual experiments were run.

I used light sources of my own making. Light for red treatment was supplied by two 40 watt Westinghouse daylight fluorescent lamps spaced nine cm apart with a white reflector which was 87.63 cm. from the seeds. In Group B trials the tubes were 13 cm apart and one meter from the seeds. Light for far-red treatments in Group A came from one 100 watt incandescent bulb with white enamel reflector 46.55 cm from the seeds. In Group B, two 150 watt bulbs 30 cm apart and 30 cm from seeds were used. To obtain pure colors, I placed seeds in a cardboard box whose cover had a rectangular hole. Red light from two layers of dark red cellophane was obtained in one box and far-red light from two layers of dark red and two layers of dark blue cellophane was obtained in another. A standardization light was used first before red or far-red exposure or before the control was stored in Group B. It consisted of a Group B red light source and a 300 watt incandescent bulb both about one meter from seeds. All exposures were made for five minutes.

These are the conclusions I have reached up to now:

1. Helianthus, Mammoth Russian - After three days of darkness, red treated seeds lead in percent germination. After longer darkness periods, up to 168 hours, the trend seems to be reversed toward the far-red group by an unknown factor. Far-red light stimulates greater root length and production of root hairs.
2. Lettuce, Grand Rapids - Consistent results were obtained. Control germination exceeded that in red or far-red groups. Red treated seeds had higher percent germination than far-red treated seeds.

3. Corn, 255-80 Day Hybrid Seed - Red leads all seeds in Group A. In Group B far-red light showed a tendency to stimulate root and shoot development. Further experiments with corn of a low normal germination rate are necessary.

4. Oats, Wisconsin - Consistent results were obtained. Far-red irradiation causes germination increases of about 11% over control seeds. Red lags behind both groups. Far-red light causes long thin roots and shoots of equal length or roots are longer than shoots. Red light yields long sturdy shoots but short knotted roots.

In the future I intend to conduct further experiments on these and other seeds under varying light and temperature conditions and possibly try to isolate the protein responsible for the behavior I have observed.

* * * *

SENSITIVITY OF A METAL DETECTOR TO VARIOUS METALLIC ORES

By George Rossman

Regis High School, Eau Claire

A manufacturer of metal detectors advertises that his products will detect the black sands (the mineral magnetite) that are associated with native gold in addition to metals. Metal detectors, I have discovered, do more than detect just this one mineral in addition to the native metals; I have found 11 minerals and many rocks that give definite reactions with a detector.

In my studies of these reactions, I am using a one transistor metal detector, the plans of which appeared in a 1958 issue of Science

Experimenter magazine. I made two changes to the design in order to adapt it to my work. The detector was intended to be used with a 5 1/4 inch diameter search coil; however, I found it to my advantage to reduce the size of the coil to 3 inch diameter. This coil is more suited to my work since it enables a reaction with small specimens. I also found it necessary to relocate an earphone connection in order to use the smaller coil.

Using field work, private, high school, and college collections, I found 11 minerals that react. A reaction is a change in the sound tone of the detector. The minerals and their reactions are as follows:

Almandite (garnet)	$\text{Al}_2\text{Fe}_3(\text{SiO}_4)_3$	none and faint decrease
Native Arsenic	As	great increase
Cobaltite	CoAsS	great increase
Native Copper	Cu	moderate increase



Franklinite	$(\text{Zn}, \text{Fe}, \text{Mn})\text{O}(\text{Fe}, \text{Mn})_2\text{O}_3$	faint decrease
Galena	PbS	moderate increase
Graphite	C	moderate to great increase
Hornblende	$\text{Ca}_3\text{Na}_2(\text{Mg}, \text{Fe})_9(\text{Al}, \text{Fe})_2$	none and moderate
	$\text{Si}_{15}\text{O}_{44}(\text{OH})_4$	decrease in magnetic specimens
Magnetite	Fe_3O_4	great to very great increase
Pyrrhotite	Fe_5S_6 to $\text{Fe}_{16}\text{S}_{17}$	great increase
Stibnite	Sb_2S_3	none and great increase

I have been unable to find any property common to all the specimens, although I have discovered certain sets of properties that include many of the specimens.

Iron content: from 30 to 72% in reactive specimens.

However, some minerals containing as much as 70% do not react.

Magnetism: all magnetic rocks and minerals react.

Not all that react are magnetic.

Dark and opaque or metallic: the only exception is the garnet. It was, however, extremely dark. Not all opaque or metallic specimens react; the majority don't.

Elements: it can be presumed that all native metals would react. Not all elements react.

Numerous rocks from Wisconsin, Michigan, and Minnesota also react. The rocks are usually feebly magnetic. Magnetite, a mineral found in these rocks, and a common impurity in other minerals, will bring about a reaction in near microscopic quantities. The minerals that cause the reactions are to be found throughout much of the country. I have not been able to do extensive studying of the rocks of the country and, therefore, most likely, I have found only one region in the nation where reaction giving rocks are found, the Wisconsin, Minnesota, Michigan region.

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HYDROGEOCHEMICAL CHROMATOGRAPHIC ANALYSIS FOR URANIUM

By Robert Brock
Appleton High School

With the increasing interest in the atomic minerals it is necessary to facilitate the novice geologist with a means of determining the amount of metal (in this case uranium) present in a particular sample, and with this data, determine the economic value of an area. This method supplies a fast and fairly accurate method for finding the amounts of uranium present in micrograms per liter, in natural water.

I became interested in the study of hydrogeochemistry while attending the National Science Foundation's Summer Institute at the Colorado School of Mines. I did some work with lead and zinc, using dithiazone there, and then discovered the possibilities of uranium, and decided to try it. I picked the Clintonville area for my survey because of the granitic type rock present, affording a good location for the deposition of the uranium minerals.

(Continued on page 123)

DESCRIPTION OF THE CHIPEWAY RIVER*

By Jonathan Carver



Capt. JONATHAN CARVER.

From the Original Picture in the possession of Mr. J. C. Carver, Esq.

Having concluded my business at La Prairie le Chien, I proceeded once more up the Mississippi, as far as the place where the Chipéway River enters it a little below Lake Pepin. Here, having engaged an Indian pilot, I directed him to steer towards the Ottowaw Lakes which lie near the head of this river. This he did, and I arrived at them the beginning of July.

The Chipéway River, at its junction with the Mississippi, is about eighty yards wide, but it is much wider as you advance into it. Near thirty miles up it separates into two branches, and I took my course through that which lies to the eastward.

The country adjoining to the river, for about sixty miles, is very level, and on its banks lie fine meadows, where larger droves of buffaloes and elks were feeding, than I had observed in any other part of my travels. The track between the two branches of this river is termed the Road of War between the Chipéway and Naudowessie Indians.

The country to the Falls marked in the plan at the extent of the traders travels, is almost without any timber, and above that very uneven and rugged, and closely wooded with pines, beach, maple, and birch. Here a most remarkable and astonishing sight presented itself to my view. In a wood, on the east of the river, which was about three quarters of a mile in length, and in depth farther than my eye could reach, I observed that every tree, many of which were more than six feet in circumference, was lying flat on the ground torn up by the roots. This appeared to have been done by some extraordinary hurricane that came from the west some years ago, but how many I could not learn, as I found no inhabitants near it, of whom I could gain information. The country on the

* - From "Travels Through the Interior Parts of North-America, in the Years 1766, 1767, and 1768," by J. Carver, Esq.

west side of the river, from being less woody, had escaped in a great measure this havoc, as only a few trees were blown down.

Near the heads of this river is a town of the Chipe'ways, from whence it takes its name. It is situated on each side of the river (which at this place is of no considerable breadth) and lies adjacent to the banks of a small lake. This town contains about forty houses, and can send out upwards of one hundred warriors, many of whom were fine stout young men. ...

In July I left this town, and having crossed a number of small lakes and carrying places that intervened, came to a head branch of the River St. Croix. This branch I descended to a fork, and then ascended another to its source. On both these rivers I discovered several mines of virgin copper, which was as pure as that found in any other country.

Here I came to a small brook, which my guide thought might be joined at some distance by streams that would at length render it navigable. The water at first was so scanty, that my canoe would by no means swim in it; but having stopped up several old beaver dams which had been broke down by the hunters, I was enabled to proceed for some miles, till by the conjunction of a few brooks, these aids became no longer necessary. In a short time the water increased to a most rapid river, which we descended till it entered into Lake Superior. This river I named after a gentleman that desired to accompany me from the town of the Ottagaumies to the Carrying Place on Lake Superior, Goddard's river.

To the west of this is another small river, which also empties itself into the Lake. This I termed Strawberry River, from the great number of strawberries of a good size and fine flavour that grew on its banks.

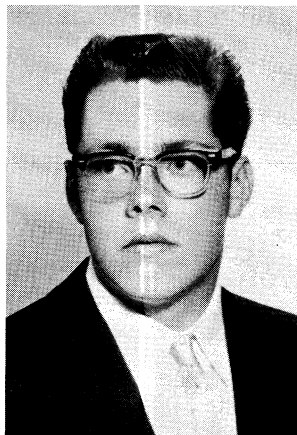
The country from the Ottowaw Lakes to Lake Superior is in general very uneven and thickly covered with woods. The soil in some places tolerably good, in others but indifferent. In the heads of the St. Croix, and the Chipe-way Rivers, are exceeding fine sturgeon. All the wilderness between the Mississippi and Lake Superior is called by the Indians the Moschettoe country, and I thought it most justly named; for, it being then their season, I never saw or felt so many of those insects in my life.

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Procedure: A 500 ml. sample of stream water is collected and acidified with HNO_3 . Dibasic Sodium Phosphate is added to the sample until the pH is 6.1. This results in a uranium phosphate complex. The purpose of the phosphate ion is a carrier, and also it is an ion which will adhere to the cellulose slurry, which I am using as a filtering medium. The 500 ml. sample is vacuum filtered through the slurry which is located in the base of a gooch crucible.

The filtration requires about an hour, varying directly with the vacuum. After filtration, I transferred the slurry into another crucible, and acidified it again. Then I put it on a hot plate, and allowed the water to evaporate. The next step is perhaps the most lengthy of all. The slurry is fired over an open flame until only a white ash remains. The residue is acidified again, and evaporated, then the acidification is repeated. After the residue is cooled, I added a solution of nitric acid and aluminum nitrate (2 ml.) to the contents of the crucible. The purpose of the aluminum nitrate solution is to break up the Uranium Phosphate complex, and to furnish an excess of (NO_3) ions which is a necessity for the uranium to move on the chromatogram. Next a .02 ml. sample from the contents of the crucible is placed on a CR-1 piece of chromatographic paper, along with known amounts in half the quantity. (The standards may be made with uranyl nitrate, or purchased from the A.E.C. I made my own, of .1, .2, .4, .8, 1.5, 3, and 6 micrograms.) The chromatogram is then desiccated at 50% for a good separation on the chromatogram. After a half hour, I removed the chromatogram and placed it in a beaker filled with an ethyl acetate, nitric acid, H_2O solvent mixture. As the solvent moves up the paper by capillary action, the uranium (brown band) and the iron (blue band) is deposited via adsorption, the iron being adsorbed more readily than the uranium and thus being at the base of the chromatogram. After the solvent has moved to within one inch of the top, it is removed and dried, after which it is sprayed with a 5% potassium ferrocyanide solution which is used as an indicator. The brown uranium band which appears is uranium ferrocyanide. The blue band is either a ferro or a ferric ferrocyanide. I haven't been able to differentiate between the two as yet, as they both appear as a blue band. This procedure is sensitive from .1 microgram up to 1000 micrograms and the results compare very favorably with fluorometric analysis.

Problems: One problem which may occur, but that I did not run across is the precipitation of calcium, etc. upon addition of HNO_3 to the sample. This may be removed with E.D.T.A. which causes the calcium to become soluble. Another problem, which I did encounter, was complexing of the uranium ion with the glass collection bottle causing a uranium silicate complex and a loss of uranium in the sample. This may be avoided by acidifying the sample right after collection, or by using borosilicate glass. The last major problem I found was a discoloring of my chromatograms due to reduction of the ferrocyanide; I halted this with a thorough bath in distilled H_2O . The areas of higher concentration found are connected and it is possible to determine possible presence of ore deposits. I plan to find a method similar to this for finding copper and cobalt in the same area I am working in. #



A DETERMINATION OF THE RATE OF ION MIGRATION IN AN AQUEOUS SOLUTION

By Ronald S. Remmel
Nicolet High School, Milwaukee



In this project the velocities of many common ions were found by observing directly the movement of the ions. As an illustration of the method used, suppose an electrode is placed at each end of a shallow bowl filled with a 1 N. NaNO_3 solution. Then a drop of some test electrolyte such as FeCl_3 is placed in the center of the bowl. When the current is turned on, the Fe^{+++} ions begin to move toward the cathode and the Cl^- ions move toward the anode. Because Fe^{+++} ions are colored, their movement can be observed directly. The movement of the Cl^- ions can also be followed by letting them migrate, turning the power off, and adding AgNO_3 . The white AgCl precipitate marks the location of the Cl^- ions. The visibility of the Fe^{+++} ions can also be enhanced by precipitation. Besides color and precipitation as a means of

locating the ions, use of the radioactive tracer element I_{131} has also been successful.

Because convection currents, diffusion, and other forces quickly spread the test solution around, agar gel or cornstarch gel was used. The gel merely holds the solution as a whole in place, but does not seem to interfere with the migration of the ions.

Four types of apparatus have been used. In the latest seven test ions can be run at once. Because the rate of migration increases with temperature, the ions are migrated through thin glass tubes immersed in a temperature-stabilized water bath to provide known isothermal conditions throughout the test tracks. The 1 volt/cm. potential gradient is maintained in the test track by comparing the voltage across the 10 cm. test track to the voltage of a 10 volt mercury battery. Any difference as indicated on a sensitive transistorized microammeter is compensated for by adjustment of the power supply. A home-made power supply used with a transistorized voltage stabilizer furnishes the power for all tests.

To date 40 tests have been run. On the next page is a chart of the rates found for 20 of the ions tested. All values were found in 1 N. NaNO_3 in agar or cornstarch gel at a potential gradient of 1 volt/cm. and at an average temperature of about 24°C .

Several conclusions have been made from the data obtained in this project. These are:

1. Ions do migrate.
2. Ions migrate toward the electrode of opposite charge.
3. Each ion has a characteristic migration velocity.
4. Ions migrate fairly independently of the other ions present. However, ions migrate somewhat faster in a more dilute solution, evidently because of the greater degree of dissociation of the electrolyte in the more dilute solution.
5. The rate of migration increases about 5%/°C. of temperature increase.
6. Ions spread along the track somewhat, even though all were started at one point. Distribution seems to follow the probability curve.
7. Anions generally migrate faster than cations. Assuming that ions are hydrated and that cations are more hydrated than anions because of the unsymmetrical polar nature of water molecules explains this fact.

THE RATES OF MIGRATION

Cation	Velocity 10 ⁻⁴ cm./sec.	Anion	Velocity 10 ⁻⁴ cm./sec.
Co ⁺²	3.4	Cl ⁻	6.7
Cu ⁺²	3.5	Br ⁻	7.0
Cr ⁺³	3.2	I ⁻	6.8
Ca ⁺²	3.5	CrO ₄ ⁻²	4.9
Sr ⁺²	3.1	Cr ₂ O ₇ ⁻²	4.8
Ba ⁺²	2.9	Fe(CN) ₆ ⁻⁴	3.3
Ag ⁺	4.2	Fe(CN) ₆ ⁻³	4.6
Fe ⁺³	2.9	SO ₄ ⁻²	3.6
Fe ⁺²	3.0	OH ⁻	6.1
Ni ⁺²	2.7		
Ni(NH ₃) ₆ ⁺²	1.4		

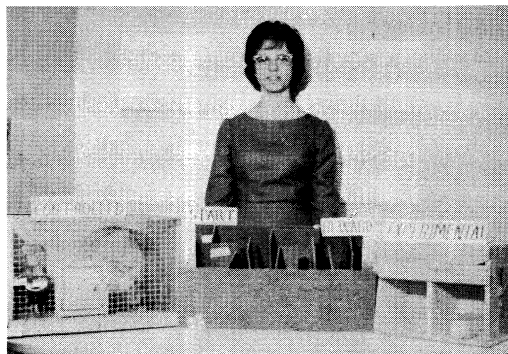
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THE PSYCHOLOGY OF LEARNING

By Donna Gratz
Fennimore High School

What is learning? Is there more than one kind of learning? If so, what are they? What are the factors which help or hinder our ability to learn? These questions I hoped to answer when I started my science project.

My first step, after reading several books on psychology, was to purchase four white mice. Since these mice were obtained from a pet store I had no way of knowing the natural intelligence of the individual mice before I bought them.



After observing the mice for four weeks I divided them into two groups as closely comparable to each other as possible. Two mice were placed in individual cages; two remained together in one cage. The mice in the individual cages were fed poor, unbalanced diets, while the other two were given a well balanced diet. During the third and fourth weeks of this feeding period each mouse was

placed on the maze one at a time. My records showed at the end of this time that the mice that had had a well balanced diet learned the maze faster, but they did not retain what they had learned very long. Whereas, the mice that had been fed a poor diet took a longer time to learn the maze and find the food, they remembered longer and each succeeding day were able to find the food faster than the day before.

From this data I concluded that the experimental mice--that is, the mice on a poor diet--reacted to the food as a reward. Because they were hungry the food at the end of the maze acted as a motivation and a reward to the mice. This experiment is an example of instrumental conditioning.

The second phase of my experiment dealt with music as an outside factor in learning. The two sets of mice were placed on balanced diets. Each mouse was placed on the maze, one at a time, as before. When the mice from the controlled group were on the maze, slow soothing music was played. Loud jazz music was played for the experimental group.

My data showed that the jazz music, when played at a low volume, had very little effect on the behavior or rate of learning of the mice. But as the volume increased the mice became nervous and were unable to make accurate decisions. The soothing music seemed to have very little effect on the mice in the controlled group and they were able to run the maze faster than the experimental group.

I hope to continue with this experiment next year and find further answers to my questions about learning.

* * * *



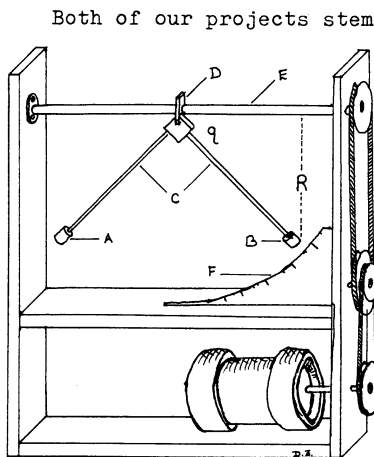
ATTEND THE 92nd ANNUAL MEETING, MAY 4-6, 1962
WISCONSIN STATE COLLEGE — LA CROSSE
General Theme — "Upper Mississippi Valley"



MASS DETERMINATION WITHOUT GRAVITY

By David ZavadiI and Warren Esty
Brookfield High School

With the tremendous strides recently taken in the field of space exploration, the idea of self-contained laboratories beyond the earth's surface becomes feasible. This will, of course, bring about innumerable problems, major among these being accurate experimental control. With this in mind, we joined together this year to explore the problem of "Mass Determination Without Gravity."



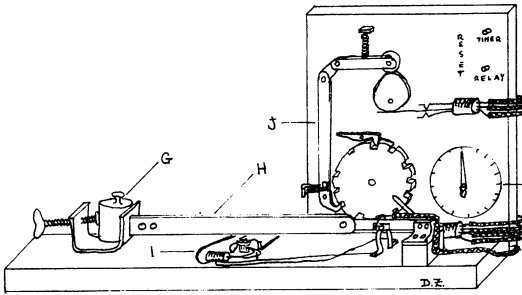
Both of our projects stem from the early postulates of the great English Natural philosopher Sir Isaac Newton. Our first method dealt with the principles of centrifugal force. To meet the problem, we devised a mechanism employing a constant mass (a) and an unknown mass (b) fixed to the ends of a right-angled fixture (c) and attached through a hinged coupling (d) to the rotating shaft (e). As the shaft rotates, the fixture is free to swing in a plane parallel to the shaft, while revolving with it.

Since C.F. (centrifugal force) = $\frac{MV^2}{R}$, where M=mass, V=velocity, and R=radius, then, according to Newton, $M = \frac{FR}{V^2}$.

Thus, if our unknown mass is infinitely small (and the fixture is of minimum mass) the radius of the unknown (R in the diagram) relative to the shaft would approach zero, and the mass would seek a position parallel to the shaft. If the unknown was of infinite mass, the radius would have to be at a maximum, and the mass would seek a position nearly perpendicular to the shaft. Therefore, any unknown mass will seek a certain position relative to the shaft between 0° and 90°. A gradient curve (f) was calibrated directly in grams, and the mass of the unknown could be read directly from it, as any given angle (q) would represent a certain mass.

Our other method attacked this problem on the basis of Newton's second law of uniformly accelerated motion, $F=MA$, where F=force, M=mass, and A=acceleration. Solving this relationship for mass, $M = \frac{F}{A}$, and substituting one of the formulae for acceleration, $A = \frac{L}{T^2}$, where A=acceleration, L=length, and T=time, into it we get: $M = \frac{FT^2}{L}$. Thus, employing a constant force, and uniform path of travel, a square root relationship between time and mass becomes apparent.

To apply this principle, an unknown mass (g) is attached to the end of a spring-loaded arm (h). As the arm vibrates in regular periodic motion, the spring (in this case an old hacksaw blade) imparts a certain force to the mass, and the amplitude of



the period is held standard by a fixed reference starting point. The device is equipped to "count" a certain number of vibrations of the arm through a solenoid sensing mechanism (i) by an escapement type relay (j). The timer (k) is started with the arm cycle and is stopped after a certain number of vibra-

tions by the relay. Since time is proportional to mass, the timer face may be calibrated in grams since every particular time period has its respective mass.

It should be noted that since both of these devices are dependent on the mass of an object, not its "weight," they will work where objects are "weightless." The first device is very accurate through a range of zero to about five grams, while the other, although less sensitive, has a capacity of close to 200 grams, at which point secondary bending in the spring greatly impairs its accuracy.

* * * *

THE EFFECTS OF RADIATION ON LIVING ORGANISMS

By Michael Swanson and Thomas Klug
Cathedral High School, Superior

While a check was made of the availability and the possibility of obtaining radioactive materials under a general license permit, tests were conducted on luminous paint which was found to be slightly radioactive.

Luminous paint was applied to a glass slide which was then covered with another slide. Euglena were placed on it different times and they were observed 15 minutes each time. No observable changes occurred in the euglena. Five test tubes were then painted. In each tube was placed a small culture. Observing them over a two-week period, no effects were observed. Some euglena were then injected into a special slide, which will keep a few drops for several weeks. A few drops of the radioactive iodine¹³¹, which had been obtained, were injected into the same slide. The euglena could be observed while the iodine was being injected. No changes were observed at that time nor during the following week. The inoculated cultures contained euglena that looked like and moved the same as those in the controls.

Next white worms were fed bread which had been soaked in the radioactive iodine solution. The purpose of this was to directly expose the internal organs. The worms were found to be radioactive but were no different from those in the control. Recently two young worms were placed in separate test tubes with food. One was exposed to the iodine while the other was kept as a control. Up to this time, each of the larvae are developing normally. It is too early to tell whether there will be a change before it develops into a beetle.

Another phase of our project was the studying of the effects of small doses of radiation on living tissue. To study this effect, living tissue was cultured. Because of improper incubation equipment, our first attempts in production of chick embryos were unsuccessful. We then used brain, heart, liver, and lung tissue from pigeons.



It was necessary in these tests that the aseptic technique be used. The dishes, pipettes, cover slips, etc. were sterilized by means of steam heat; whereas the slides, forceps, and scalpel were sterilized in alcohol, and the tables and our arms were scrubbed with a lysol solution. After we had learned the aseptic technique, the tissue extract was made and so were slides of normal and irradiated tissue. Phosphorus³² was used.

To measure the amount of growth, a fairly accurate standard of measurement had to be used. Our standard of measurement consisted of a ball of light under a constant magnification of 100x, which was divided into five equal parts. The growth could be recorded as 1, 2, 3, etc. The result was that there was a general retardation of the tissue exposed to radioactive phosphorus after 24 and 48 hours of incubation. The lung tissue was an exception to this, for the new growth was twice that of the control.

The results of our project may be summarized as follows:

1. The I¹³¹ had no immediate apparent effect on euglena.
2. The I¹³¹ had no observable effect on white worms or on Tenebrio larvae.
3. The radiation from luminous paint was not sufficient to affect euglena.
4. The P³² had a general retardation effect upon the growth of pigeon tissue.

* * * *

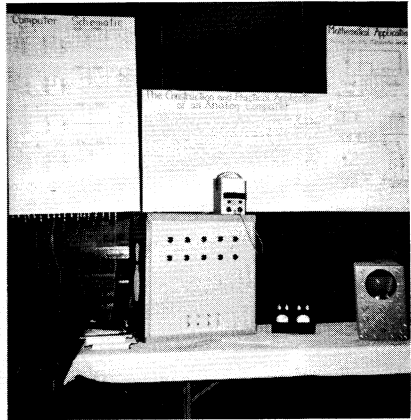
THE CONSTRUCTION AND PRACTICAL APPLICATION OF AN ANALOG COMPUTER

By R. John Swing, Jr.
Aquinas High School, La Crosse

Exemplified in this apparatus, I have endeavored to demonstrate an entirely new approach in computers. This approach is unique in two ways:

1. The potential of electronic analog computers, in contrast to the highly developed digital systems now in use, has been realized only recently by scientists, and is in its early stage of development with unlimited possibilities.
2. I have devised a unit using variable direct current (D.C.) power supplies, eliminating the very costly high gain D.C. amplifiers, and employing resistive controls to accomplish the net results, and thereby keeping cost at a minimum.

To further reduce the cost of this unit, which would still be over \$60, I found parts from old radios, a television set, pinball machines, and scrap bins, to accomplish the desired function of circuitry, thereby lowering my cost under \$15. This system utilizes the mathematical characteristics of electricity to arrive at a solution: i.e., 2 volts plus 2 volts equal 4 volts, or, 4 ohms with 2 amps equal 2 volts, etc.



The capabilities of this computer are many and varied. It has the capacity of doing linear equations, and with elaborations could perform quadratic equations also. It can multiply, divide, add, and subtract, and in most cases, the function can be performed in more than one way, assuring ourselves of a more accurate solution. Theoretically, the analytic characteristics of this computer are inestimable because it covers the infinity of fractions due to its continual reading of $0...1,.,,2$, etc. The extent of the infinity used would depend upon the specialization of the potentiometers applied.

In the construction of this unit, many problems were met. My most difficult would be that of carrying out my plans to graph the algebraic equations on the oscilloscope. I soon discovered that my scope could not be applied, because it had a flat response of five cycles per second, whereas my computer had a D.C. output requiring a D.C. coupled scope which was financially out of the question. Consequently I proceeded to devise a repetitive system, with relays, which I had on hand, that would repeat my solution over five times per second, and thereby attain a graph on my A.C. coupled oscilloscope. The outcome is favorable; however, the ideal circuit, I feel, would be an electronic switch with a variable speed regulator, which would be too costly for this project. This would eliminate arcing and relay chatter, and produce a more distinct graph.

Shown on the front panel are my variable resistor controls, with all contacts and voltages brought to the front, which I connect through use of patch cords to perform a specific function.

This system can be developed to such an extent to perform such functions as differentiation, integration, and various other forms of calculus and advanced math. The apparatus in its present stage demonstrates the workability of my circuits and their possible future applications.

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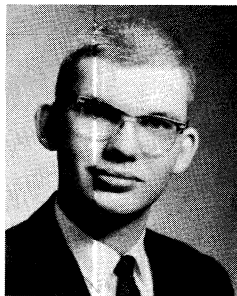


COMPUTER COMPONENTS

By Robert L. Cooley
Mary D. Bradford High School, Kenosha

The purpose of this science project is to illustrate the basic electrical principles on which a digital computer works, and to show these principles at work in a binary adding machine. The project was constructed from parts of a pinball machine purchased for \$5.

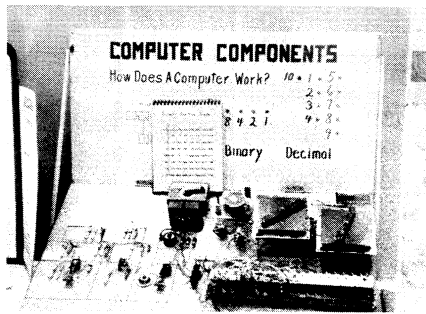
The adding machine portion of this project uses electrical relays, which "relay" an impulse from one circuit to another. The relay converts an electrical impulse to magnetism, thus opening or closing an arbitrary number of switches. A network of such relays can be wired to perform a desired function.



There are several types of relay switching circuits. The simplest is called the DO switch (the name comes from symbolic logic). This is the simple on-off switch. In the IF, THEN circuit, using a double-throw switch, if the switch remains in the normal position, the first bulb lights, and if the switch is depressed, then the second bulb lights. In the AND circuit (two switches in series), both switches must be pressed to light the bulb. In the OR circuit (parallel), either switch will light the bulb. In the EITHER BUT NOT BOTH circuit, the bulb will go out when both switches are pressed. A machine remembers, too. An impulse may be used to hold a relay on, thus retaining the signal. An example of the relay is the common buzzer; a switch on the relay rapidly opens and closes the circuit. Although relays are used in this project the electron tube and the transistor have their advantages and perform much the same functions as the relay.

Since a digital computer operates on the on, off property of an electrical circuit, it uses the binary number system to express our own decimal numbers in terms of zero and one, which correspond electrically to off and on. If the machine were to add 1 and 1, it would get the answer 10 (the binary 2). This requires a zero in the first place. This is obtained in the EITHER BUT NOT BOTH circuit, where two on impulses result in an off impulse.

Since the computer is binary, the decimal numbers have to be translated into binary; the adding operation is performed; and the binary result must be changed back into the decimal number system.



A set of punched cards translates the decimal numbers into the binary (in the form of holes and slots, ready for direct input to the machine.) The total of the machine is expressed in the binary by four light bulbs. To translate to decimal, the decimal value of

each bulb (1, 2, 4, or 8) is registered by contacts on a wheel, and sends impulses to a second wheel which counts up the total in decimal.

This final stage of the computer, the binary to decimal stage, was the most original, required the most experimentation, and caused the most trouble. It uses two repeating relays and a stepping motor. It was originally planned to advance in buzzer fashion, but was erratic in behavior and finally required the motor, to allow smooth advancement of the mechanism.

As well as being an educational demonstration and a scientific experiment, this project provided a good background in the computer field to the experimenter.

* * * *

THE ULTIMATE SUM OF THE DIGITS IN NUMERICAL FUNCTIONS

By Allen Tobin

Regis High School, Eau Claire

The ultimate sum of the digits of any number can be found by completely adding its digits until the result is a number from 1 to 9. Example: 439. If we add 4, 3, & 9, we get 16. If we add 1 & 6, we get 7, the ultimate sum of the digits of 439. Notice that the result will be the same if we do not use 9 in finding the result. This is always the case for 9's or combinations of numbers which equal 9. 9 will be the result if all that we have are 9's and/or combinations of numbers which equal 9.

The ultimate sum of the digits of a fraction is the ultimate sum of the digits of the numerator in a ratio to the ultimate sum of the digits of the denominator. Example: $\frac{21}{22}$. The ultimate sum of the digits is $\frac{3}{4}$.

ADDITION: The ultimate sum of the digits of the ultimate sum of the digits of "a" plus the ultimate sum of the digits of "b" equals the ultimate sum of the digits of "c". Example: $4356 + 3755$. The ultimate sum of the digits of 4356 is 9. The ultimate sum of the digits of 3755 is 2. $2 + 9$ equals 11. $1 + 1$ equals 2. Thus 2 is the ultimate sum of the digits of $4356 + 3755$, which is also the ultimate sum of the digits of their actual sum, which is 8111. For fractions, one must first have a common denominator, when one finds the ultimate sum of the digits of the numerators and places it over the ultimate sum of the digits of the common denominator.

SUBTRACTION: The ultimate sum of the digits of the ultimate sum of the digits of "a" minus the ultimate sum of the digits of "b" equals the ultimate sum of the digits of "c", plus 9. The reason for plus 9 is when the result is negative or 0. Example: $4322 - 3543$. The ultimate sum of the digits of 4322 is 2. The ultimate sum of the digits of 3543 is 6. $2 - 6$ equals -4. Since -4 is negative, we must add 9. The result is 5, the ultimate sum of the digits of $4322 - 3543$, which is also the ultimate sum of the digits of their actual difference, 779. For fractions, do as in addition, but use subtraction or the numerators.

MULTIPLICATION: The ultimate sum of the digits of the ultimate sum of the digits of "a" times the ultimate sum of the digits of "b" equals the ultimate sum of the digits of "c". Example: 43×35 . The ultimate sum of the digits of 43 is 7. The ultimate

sum of the digits of 35 is 8. 7×8 equals 56. $5 \& 6$ equals 11. $1 \& 1$ equals 2. The result is 2, the ultimate sum of the digits of 43×35 , which is also the ultimate sum of the digits of their actual product, 1505.

THE ULTIMATE SUM OF THE DIGITS OF ANY NUMBER TO ANY POWER:

- Find the ultimate sum of the digits and locate the result on "a"
 - Divide the exponent by 6. Locate the remainder on "b". If 6 goes into it an equal number of times, locate "6" on "b".
 - Where they cross is the result.
- * When the actual numbers are 3 and 6 and whenever they are to the first power, the ultimate sum of the digits of each of them to the first power only is 3 and 6 respectively.

a. b.	1	2	3	4	5	6
1	1	1	1	1	1	1
2	2	4	8	7	5	1
3*	9,3	9	9	9	9	9
4	4	7	1	4	7	1
5	5	7	8	4	2	1
6*	9,6	9	9	9	9	9
7	7	4	1	7	4	1
8	8	1	8	1	8	1
9	9	9	9	9	9	9

NOTE: Portion shaded is in red type.

PERMUTATIONS OR COMBINATIONS:

- When no number can be used with itself to form a pair

x = any number

$y = x - 1$

$z = x + 1$

c_1 = number of combinations

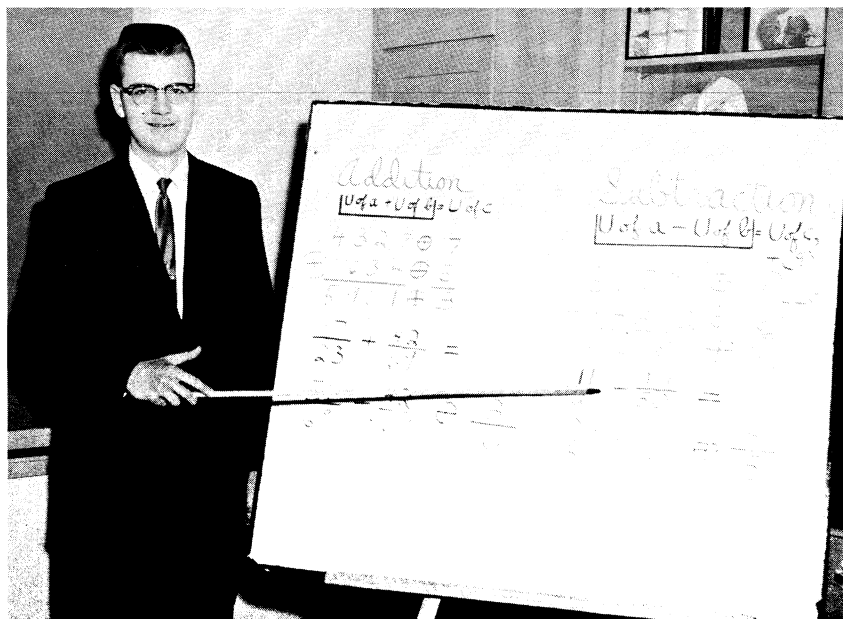
a_1 = sum of all the numbers of all the possible combinations

Example: 5

1. 1, 2 1, 5 2, 5 4, 5 $c_1 = \frac{1}{2}xy$

1, 3 2, 3 3, 4 $c_1 = \frac{1}{2}(5)(4)$

1, 4 2, 4 3, 5 $c_1 = 10$



1. $c_1 = \frac{1}{2}xy$ 2. $a_1 = c_1z$ 3. c_1 of $x - c_1$ of $y = y$
 2. $a_1 = c_1z$ $a_1 = 10(6)$ $10 - 6 = 4$
 3. c_1 of $x - c_1$ of $y = y$ $a_1 = 60$

2. When a number is used with itself to form a pair

$x = \text{any number}$

$y = x - 1$

$z = x + 1$

$c_2 = \text{combinations}$

$a_2 = \text{sum of all the numbers of all the possible combinations}$

1. $c_2 = \frac{1}{2}xz$

2. $a_2 = c_2z$

3. c_2 of $x - c_2$ of $y = x$

Example: 3

1. 1, 1 2, 2 $c_2 = \frac{1}{2}xz$

1, 2 2, 3 $c_2 = \frac{1}{2}(3)(4)$

1, 3 3, 3 $c_2 = 6$

2. $a_2 = c_2z$ 3. c_2 of $x - c_2$ of $y = x$

$a_2 = 6(4)$ $6 - 3 = 3$

$a_2 = 24$

SIMPLIFICATION OF ROOTS OF FRACTIONS:

The formula explains itself.

Example:

$$\sqrt[n]{\frac{a}{b^c}} = \sqrt[n]{\frac{ab^{n-c}}{b}}$$

$$\sqrt[3]{\frac{5a^2b}{7c^3d}} = \sqrt[3]{\frac{5a^2b(7c^3d)^2}{7c^3d}} =$$

$$\sqrt[3]{\frac{245a^2bc^6d^2}{7c^3d}} = \sqrt[3]{245a^2bd^2}$$

* * * *

St. Nicholas Mag., Feb. 1879



WHEN MY SHIP COMES IN.

ITEMS from minutes of Wisconsin Junior Academy of Science State Committee meeting on May 6, 1961, following last Senior Academy Council meeting:

***After explanation of the suggestion of the Senior Academy Long-Range Program Planning Committee concerning separation of Junior and Senior Academy annual meetings, it was voted to reject the plan. It was further voted that the Junior Academy annual meeting be concurrent with and at the same place as that of the Senior Academy, continuing the plan of past years.

***To encourage membership in the WJAS and increase payment of club dues, a revision of the brochure was agreed upon,

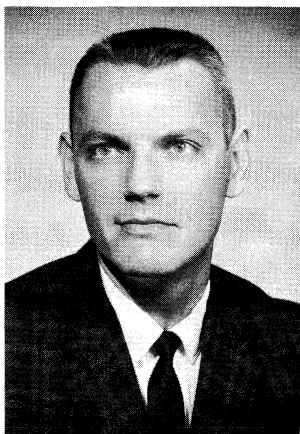
and it was further suggested that the Junior Academy encourage membership of high school students in the Senior Academy.

***A proposal to the NSF was unanimously favored: Research participation for high school students which would include a fall symposium, a summer of research at a research institution, a program of papers based on their study, and publication of the papers. (Above sketch for attention-catching only! Did it work?)



JUNIOR ACADEMY NEWS

INTRODUCING — JACK ARNDT



JACK R. ARNDT is the new chairman of the Junior Academy activities. He is an instructor in pharmacy at the University of Wisconsin Extension Division and is continuing his studies in the school of education there. For the past two years he was assistant director of NSF-sponsored academic year institutes and research participation programs for high school teachers.

Born in Saginaw, Michigan in 1932, he had his early education there and then obtained his B.S. in pharmacy at Ferris Institute (Big Rapids, Michigan). Mr. Arndt came to Wisconsin as a teaching assistant in 1953 and was granted the M.S. in pharmacy in 1956. After a year at North Dakota State College, he returned to Madison as practice teacher at Wisconsin High School before rejoining the University staff. His present interest in the extent, stimulation, future, and effect of scientific research carried out in American high schools by students and teachers makes him an ideal leader for the Junior Academy work. Besides his own scientific vocation his hobbies are lapidary and mineralogy. He is a member of the American Institute of the History of Pharmacy, American Pharmaceutical Assn., and the Central Assn. of Science and Mathematics Teachers, as well as the Wisconsin Academy. -- G.M.S.

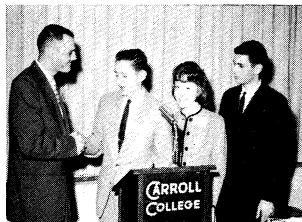
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JUNIOR ACADEMY REPORT

By Jack Arndt, Chairman
Junior Academy Committee

A heavy schedule of varied activities drew a fine crowd to the Annual State Meeting held in conjunction with the 91st Annual Meeting of the Senior Academy at Carroll College, Waukesha, on May 6, 1961. From the Friday night reception to the Sunday field trip Wisconsin students, teachers, parents and friends attended various programs, and other events.

The 25 district winners taking part in the State Meeting were all nominated for one-year honorary memberships in the Senior Academy. The scientific papers presented by the participants are included in this special W.J.A.S. issue of the Academy Review, with the exception of one not submitted.



Among those students vying for state awards, ROBERT GINSKEY, La Crosse Central, SANDRA HAGER, Milwaukee Lutheran, and MITCHELL WINNIK, Milwaukee Nicolet were selected as first, second, and third place winners respectively, and were awarded financial scholarship credit. These people were so honored at the Saturday evening banquet (see left).

Recognition was also granted SANDRA HAGER, and GEORGE ROSSMAN, Eau Claire Regis, upon being chosen by the Senior Academy for recommendation to an honorary membership in the American Association for the Advancement of Science. It also happened that these two students were elected by their fellow W.J.A.S. members as co-presidents for next year's sessions.

Judges for the sessions were RICHARD E. BAYER, Chemistry Department, Carroll College, MARY FRIEDLANDER, Physics Department, UW-M, and LUDWIG K. PAULY, Zoology Department, UW-M.

Annual Meeting Chairman ROY J. CHRISTOPH and his committee of college students deserve commendation for their efficient handling of arrangements for the Junior Academy sessions.

Junior High District Meetings

May 13 marked the date of two well-attended Junior High District Meetings. The Northern District Meeting was held at the UW Extension Center Building at Wausau. Co-chairmen for the meeting were AMOS H. YONKE, Wausau Horace Mann, and REUBEN HANSEN, Manitowoc Woodrow Wilson. LEE BUECHLOR, Wausau Horace Mann student, served as moderator for the 36-entry gathering. The judges were ROGER F. BAUER, GEORGE T. O'HEARN and CHRIS G. PAULAS, all of Wausau.



Arndt at meeting

Madison West was the site of the Southern District Meeting. C. JOSEPH ANTONIE and BRUCE MILLER, both of West, were co-chairmen of the meeting at which 24 papers were presented. Three Madison teachers acted as judges: JAMES T. STREATOR, Central, JACK E. SHERMAN, Schenk, and WAYNE H. OSNESS, UW.



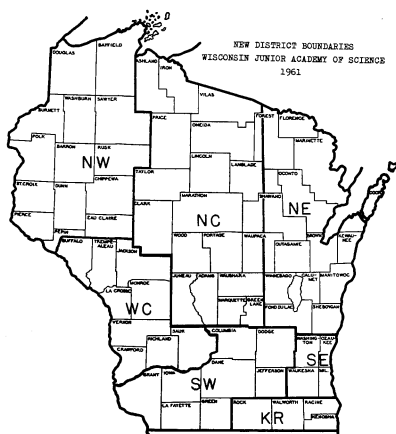
D.Monteith at meeting

Recognition for their outstanding presentations went to TOM ASHENBRENNER, JAMES LONG, and DANIEL USKY, Menasha; CYRUS ATKINSON, Shell Lake; DAVID BARTLETT and CHUCK COLE, Green Bay Franklin; JUDY BENESH, Marshall Public; LINDA DRUMM and JIM KIRLESKY, Manitowoc Wilson; DIETER ENZMANN, Racine Jerstad-Agerholm; JON FISCHER, DENIS HARRIS, MATT MILLER, and TOM POPPENDIECK, Milwaukee Nicolet; JAMES HIMLEY, Muskego; MICHAEL NOTH, Green Bay Washington; DON RAHNE and CLARK STEVENS, Wausau Horace Mann; MARGARET SCHULZ and KATHY WITT, Racine Lutheran; and RICHARD STEFFENSEN, Kenosha McKinley.

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WILLIAM SEISER, Milwaukee Public Schools, has resigned from the Junior Academy Committee.

Change of District Boundaries



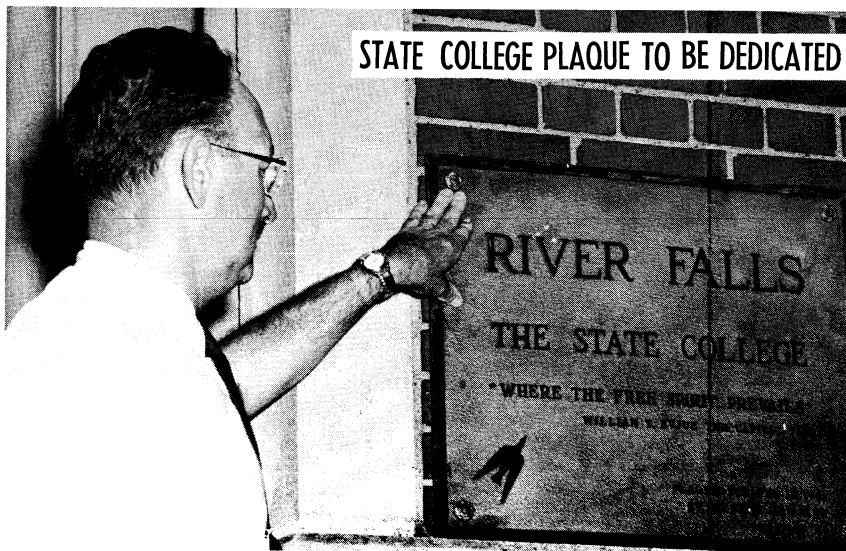
At the semi-annual meeting of the State Committee on May 6, 1961, it was voted to change three of the district boundaries. This action was taken to try to relieve some of the pressure caused by the large meetings at Milwaukee the past few years. To this end, the Committee adopted the following plan of re-districting:

- a. The boundaries of all districts remain the same except the Kenosha-Racine District (KR), the Southeast District (SE), and the Southwest District (SW).
- b. The KR District encompass Kenosha, Racine, Rock and Walworth counties.
- c. The SE District encompass only Milwaukee, Ozaukee, Washington,

and Waukesha counties.

- d. The SW District encompass Columbia, Dane, Dodge, Grant, Green, Iowa, Jefferson, and Lafayette counties.

* * * *



STATE COLLEGE PLAQUE TO BE DEDICATED

RIVER FALLS STATE COLLEGE has a new "Freedom Plaque" which carries the words "Where The Free Spirit Prevails," by WILLIAM T. EVJUE, Editor of The Capital Times, Madison. Prof. WALKER D. WYMAN, chairman of their social sciences department, suggested that the slogan, which appeared at the head of one of Mr. Evjue's columns, be perpetuated in bronze. The plaque, to be placed on North Hall, will be dedicated this fall. Two scholarships for deserving students at the college were set up by Mr. Evjue. (Photo courtesy copyrighted Capital Times, August 12, 1961, by permission)



THE BOOKSHELF

NEW LAWS FOR NEW FORESTS

By Erling D. Solberg

Univ. of Wisconsin Press
430 Sterling Ct., Madison 6
1961 611 pp. + tables \$7.50

The effort of Mr. Solberg to inquire into the ways and means, philosophies and historical background that were used in Wisconsin in the first half of this century to restore forest growth on cut-over lands is the most comprehensive job that has been done in this state, in this field. Any person who would attempt to review this subject further, inasmuch as new questions now arise, and to report on the period 1951-1961, will find the methods used by Mr. Solberg, as well as the array of references and tables he presents, the conclusions reached and the results he points out which are now so evident over about half the land area of the state, really helpful and required reading. To one who lived and worked through this period of the restoration of a resource and who participated in the efforts and measures that are dissertated upon in this book, the feeling arises that it is well that a trained person like Mr. Solberg (law and economics) detached from the active scene itself, has found it worthwhile to study the reasons and the many details that prompted many persons, companies, political bodies and institutions to act as they did to change the patterns of thought that prevailed in the uses of land in a naturally wooded state like Wisconsin, and to then be able to present a dispassionate report in depth and understanding replete with footnotes, references and tabulations. This Mr. Solberg has done in a successful way.



Much of the subject matter presented applies, as a whole, to the northern and central counties of the state but particular reference is made to affairs in Oneida County. While the recounting would be somewhat different in some of its conclusions if other counties were used as a basis of analysis, still Oneida County on the appraisal of all factors, is about the best one that could have been selected. It might also be pointed out that while forest fire, forest tax, zoning and county forests laws, all of which are discussed in the book, are factors that assisted in the good results in land use through forestry, that other influences also played important roles in the thinking of landowners and citizens generally and in the end results, so far, in forest restoration. Wisconsin made a major effort on reforestation through direct planting, establishment and management of state and national forests and forestry extension work over the same period of time but these are not discussed to any extent.

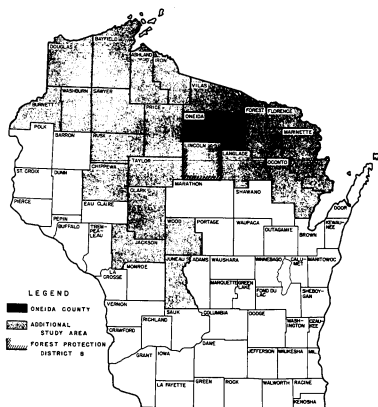


Figure 1. Location of Study Areas, Wisconsin. Oneida County was the primary study area, but data were obtained regarding operation of some land-use laws in the other counties indicated. Prepared by the University of Wisconsin Cartographic Laboratory.

gone full circle to the present philosophy of the Soil Bank program. Just think of that for a change and what it did to the hopes of so many worthy men and women who had wanted to gain independence of action and who, pressed by generations of land hunger, had aspired to own and operate a place of their own, through hard work on the northern cutovers. This experience which Mr. Solberg refers to but does not, in the opinion of this reviewer, expound in sufficient detail, is the basic reason why the pattern of land use now accepts tree growth to a degree never before known to the people of the state. It is not now a matter of soil fertility as it used to be (good soil produces good timber too) but basically a matter of getting any crop from all acres not devoted to a more productive use--a crop like trees that is needed in the economy of the state and that can be sold in the market place.

Another conclusion that can be reached from a reading of Mr. Solberg's book is that, in forestry, a task for the present and future is to simplify procedures and management so as to take increasing advantage of natural processes. Involved laws governing forest practices point up the need of freer action on the part of the landowner. This is well illustrated by the Forest Crop Law which was initially intended to encourage private effort in forestry (and which, for all practical purposes, has not been very successful) and the Zoning Law, which is so involved with necessary and safe-guarding procedures as to render its application rather ineffective. This is quite contrary to the ideas of 30 years ago which has resulted in present statutes affecting forestry chances. This reviewer recalls the constant admonitions of lumbermen of years ago that "if you keep the fire out, the country will grow up again" and wonders whether we wouldn't be substantially about where we are now in forest restoration if forest protection, which has proved more successful than any other measure, had been applied as we now know it with its acceptance among the population of the areas affected, to the exclusion of all the other laws and arrangements. The danger to the forestry

As one ponders the pages of this book, he is prompted to think of what might have happened to the whole history of land use in this state and the nation had the methods, results and needs of the population, of farming as we knew them in the twenties, not changed so drastically during the past 30 to 40 years. Horse power on the farm has been replaced by motor power, the efforts of a man, productively, has been increased several fold through agronomy, fertilizers, insect control and otherwise; water has been brought to vast acreages, both in Wisconsin and the nation, in efficient ways. These and other influences, in total, has resulted in an entirely different present area of need and method. The great effort made by many in official and unofficial circles to "colonize" the cutover lands of the Lake States and the country has

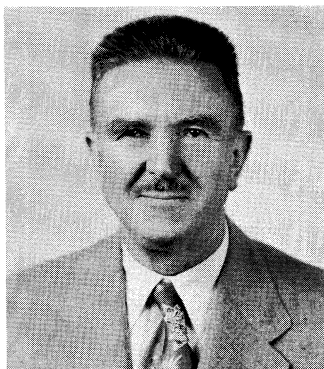
effort today is that expenses of all kinds, constantly increasing, will overcome and run ahead of the value of tree growth on affected areas. This goes for both public and private effort, but especially public effort. The time is here for further inquiry into the questions that arise as an outgrowth of laws and procedures established and evolved during the first 50 years of organized effort in forestry practices in the state with a view of elimination, revision, integration and coordination of policy and methods. The needs of the population for uses and products of the land has changed drastically during the period covered by this book. In any such study or official review and report one would feel certain that the job done by Mr. Solberg in New Laws for New Forests would be of great assistance.

--- C. L. Harrington, Madison

In Memoriam

Charles Weldon Tomlinson

1892-1960

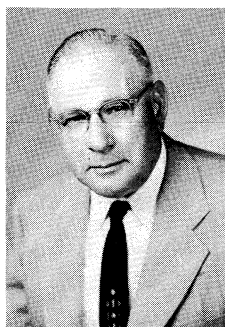


CHARLES WELDON TOMLINSON was born at Detroit, Michigan on April 23, 1892 and died at Ardmore, Oklahoma on April 3, 1960. He obtained the B.A. and M.A. degrees at the University of Wisconsin in 1913 and 1914 and his Ph.D. in 1916 at the University of Chicago. After serving as professor of geology at Mississippi A & M College for a year, he became an associate in geology at the University of Illinois where he taught the first course in petroleum geology offered there. In 1918 he was appointed a geologist with the Gypsy Oil Co. (Gulf), transferring to Schermerhorn-Ardmore Co. and affiliates in 1921. Since 1933 he had been an independent oil producer.

He was a member of many professional geological and mining associations and was president of the American Assn. of Petroleum Geologists in 1949-50. He was also a member of the American Assn. for the Advancement of Science, Phi Beta Kappa, Sigma Xi and the Oklahoma Academy of Science, and a life member of the Wisconsin Academy since 1945, having joined in 1921. Throughout his career he published extensively in geological journals, and was himself listed in *Who's Who in America*.

His civic activities were many and varied. The geologic highway signs in the Arbuckle Mountains and around Ardmore were suggested, composed and partially financed by him, and he advanced the idea of a dam at the present site of Lake Murray dam, sponsoring the surface mapping prior to erection of the structure. He served as president of the Ardmore Chamber of Commerce, helped to establish their Community Chest, was chairman of the local Red Cross, was a member of the Library Board for 13 years, organized a corporation which erected and equipped an osteopathic hospital at Ardmore, and served for many years as senior warden of St. Philip's Episcopal Church.

RETIREMENT PROFILES



FRED TRENK — Forester

FRED TRENK, professor for wildlife and extension forester at the University of Wisconsin, has been encouraging development of farm forestry in Wisconsin since 1931. A graduate of Iowa State College, he did advanced work there and was extension forester at the University of Maryland for six years before coming to Wisconsin. He has been a member of the Academy since 1954. Through his efforts there have been steady gains in the planting of shelterbelts and other farm woodlands and in efficient marketing of woods products. He has helped with the promotion of school forests and supervision of state-owned demonstration forests. Some years ago he cooperated with H. D. BRUHN of the UW agricultural engineering department in designing the first tree planting machine suitable for anything but tilled fields. This machine is still in commercial production and other tree planter designs stem from this one.

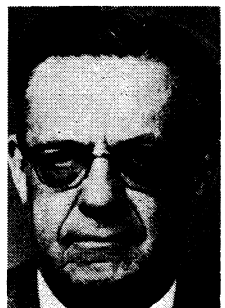
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MAY S. REYNOLDS — Nutritionist

A change in scene will follow when MAY S. REYNOLDS retires from the University of Wisconsin home economics staff in September. She will become nutrition research consultant on a Ford Foundation program in Pakistan. For 39 years she has concentrated on proteins, comparing those from synthetic and natural sources, working on low calorie-high protein weight reducing diets, and recently on a protein diet for underdeveloped countries. During the past 10 years she has directed nutrition research of some 60 graduate students from many states, Europe, India, Thailand and the Philippines. She received the 1958 Borden Award for her fundamental research in nutrition and in 1960 Iowa State University honored her as an outstanding alumnus. Prof. Reynolds joined the Wisconsin Academy in 1954.

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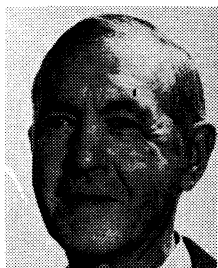


OLAF A. HAUGEN — Chemical Engineer

Another Academy member retiring from the University of Wisconsin to accept a post overseas is OLAF A. HAUGEN, widely known for his teaching and research in chemical engineering. He has been appointed science attache for the Scandinavian countries with the U. S. embassy in Stockholm, Sweden, for two years. A Wisconsin native who received two degrees from the University, he has been on its faculty since

becoming an instructor in chemical engineering in 1917. Prof. Hougen affiliated with the Academy in 1945. His career is spiced with brief periods when he worked with industries and other universities here and abroad and he has been the recipient of numerous honors and awards in his field. The latest of these (1961) were the American Chemical Society's \$1,000 Award in Industrial and Engineering Chemistry and the Lamme gold medal for distinguished achievements in engineering teaching, research and administration from the American Society for Engineering Education.

* * * *



RAYMOND J. ROARK — Civil Engineer

In 1913, RAYMOND J. ROARK joined the University of Wisconsin engineering mechanics faculty as an instructor. He had obtained his B.S. and M.S. degrees in civil engineering from the University of Illinois, but his interest in the strength and safety of structures he had to design led him into the engineering mechanics field. Interrupted by two years of service in World War I and teaching for a year at the State University of Iowa, his career as a teacher of applied mechanics and civil engineering has been

long and rewarding. Prof. Roark has also done much research in the field of statics, dynamics, strength of materials, and aerodynamics and has published several articles on the results. Co-author of a textbook on mechanics for engineers, he also wrote what is called the engineers' stress-strain bible, "Formulas for Stress and Strain." An outdoorsman with a deep interest in conservation of natural resources, his two big game hunting trips abroad resulted in several specimens for the zoological-botanical museum at the UW. He joined the Academy in 1944.

* * * *



SAMUEL M. McELVAIN — Organic Chemist

SAMUEL M. McELVAIN was honored by former colleagues and students at a symposium reviewing his career last June. One paper revealed his far-reaching discoveries relating to local anaesthetics and those presented by three former graduate students were technical studies in organic chemistry. He came to the University of Wisconsin in 1923 as instructor in organic chemistry after receiving his Ph.D. degree at the University of Illinois, and has been a full professor since 1933. In addition to his work

on local anaesthetics, he made outstanding contributions to synthetic organic chemistry and to elucidation of the active ingredients in catnip. During his 38 years of research and teaching with the University, Prof. McElvain authored two books and some 170 papers and supervised work of 80 recipients of the Ph.D. degree. He has been active in University affairs, serving on several committees. The National Academy of Science and Phi Kappa Phi, national scholastic honor society, have honored him by election to membership and he has been affiliated with the Wisconsin Academy since 1929.

* * * *

In Memoriam



Frederik T. Thwaites

1883-1961

FREDERIK T. THWAITES was born at Madison, Wisconsin on December 23, 1883 and died there June 7, 1961. He was emeritus professor of geology at the University of Wisconsin, having retired in 1954 (see Academy Review, Winter, 1955, p. 20). He had continued active in part-time teaching and with the Geological Survey and was working on notes on geomorphology toward preparation of a new text as well as co-operating with Prof. Kenneth Bertrand on a study of glacial geology and topography of Door County.

He was a life member in the Geological Society of America and in the Wisconsin Academy, having joined in 1916. He was also a member of Phi Beta Kappa and the State Historical Society.

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Dr. Erwin R. Schmidt

1891-1961

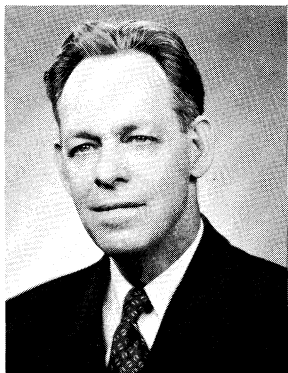
ERWIN R. SCHMIDT was born at Alma, Wisconsin in 1891 and died at St. Joseph's Island near Sault Ste. Marie, Ontario on July 9, 1961. Receiving his bachelor's degree at the University of Wisconsin in 1913, he was an assistant in anatomy for a year before going to Washington University Medical School in St. Louis. He entered the Army in 1917 after having been surgical assistant at Augustana hospital, Chicago. Going overseas in 1918, he was commanding officer of a base hospital at Nantes, France for a year. Returning to Augustana hospital, he became chief of assistant's clinic of Dr. A. J. Ochsner, his uncle. In 1921 he visited many famous European surgeons. He practiced at Billings, Montana from 1923 to 1925, when he again joined the surgical staff at Augustana.

Brought to the University of Wisconsin Medical School in 1926 to head the new surgery department, his first job was to build up its prestige. "It was like barnstorming," he admitted, for he traveled the state gaining the confidence of doctors. Over the years, his greatest contributions to his department were the gifted men he brought to the University and to whom he gave guidance and support. He had retired as chairman of the department of surgery on July 1. Dr. Schmidt was a member of numerous medical and surgical societies, including the American College of Surgeons, American Surgical Assn., International Society of

Surgery, and Western Surgical Assn., of which he was a past president. He had been affiliated with the Wisconsin Academy since 1929.

Dr. Schmidt was a senior warden at St. Andrews Episcopal Church for almost 20 years and made many contributions of time, money and donated surgery with characteristic anonymity. He insisted that a surgeon must first be a Christian gentleman, operating with his heart as well as with his head and hands. As one who had done much to elevate the surgeon's profession, he was known for his courteous and unfailing attention to each of his patients.

* * * *



George R. Griffin

1902-1961

GEORGE R. GRIFFIN was born April 12, 1902 at Muskegon, Michigan and died at Milwaukee, Wisconsin on May 6, 1961. He was professor of classics and had been a member of the Marquette University faculty for 34 years. He had studied both at the University of Wisconsin and at Marquette, and his degrees were from the latter school. He had been a member of Marquette's graduate school faculty since 1944 and became a full professor in 1956.

While still in the college of liberal arts, Prof. Griffin developed and taught a preprofessional course in English and the Latin and Greek roots of English words. He wrote articles on the classics for the World Book Encyclopedia in 1959 and 1960. For one year he left Marquette (1947) to serve as academic dean of Mount Mercy College in Cedar Rapids, Iowa. He was an honorary member of Eta Sigma Phi and a member of the American Association of University Professors, the Marquette Faculty Sodality, and of the Wisconsin Academy. --- Ann Grattan

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WISCONSIN ACADEMY REVIEW		
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ASSISTANT EDITOR: Mrs. Walter E. Scott		
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A NOTE ON THE COVER

CONNIE MARCHEL, age 14, of Waupaca Senior High School, is the artist whose work is represented on the cover of this issue. Wisconsin's young scientists have long contributed to the Junior Academy of Science. This year a counterpart for the arts was enlarged, and held for the first time at the Marathon County Youth Camp in Wausau, when the High School Art Workshop met from June 25 to July 1.

A group of girls and boys whose age range was from 13-18 years came to Wausau for a week of study in painting, drawing, graphics, sculpture, art metal, and crafts design. A large percentage came on scholarships given by their local schools, business firms, and art groups.

The 80 students were divided into classes of their specialty under the direction of some of the best artist-teachers in the state: Mrs. JOANNE GRAY of Madison, HAROLD CARLSON of Appleton, ERNIE MAHIKE of Hales Corners, and JACK OLDS, Brookfield. The workshop was administered by the Art Education Department of the University of Wisconsin, Extension Division: Director JAMES A. SCHWALBACH, assisted by JAMES SCHINNELLER, Associate Professor, and DAVID GRAY, Instructor with the Extension Art Department. The Workshop was co-sponsored by the Wisconsin Art Education Association, the State Department of Public Instruction, and the Art Departments of many of the state's public and private colleges.

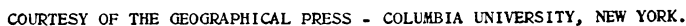
The daily schedule included a slide discussion of one aspect of art each day - a morning sketch session in the area surrounding the youth camp offered great variety of sketching material, an evaluation session of the morning work, and an afternoon class session of three hours in which the student worked in the area of his interest. Each evening the workshop was host to a Wisconsin artist who discussed his work, giving the students an insight into the ways an artist looks at things and works. These talks were presented with slides and examples of the artists' work. The day ended with an hour of refreshments and music.

---Frederick M. Logan

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