Early History of the University of Minnesota

On February 25, 1851, the governor of the territory of Minnesota approved an act of incorporation by which the University of the Territory of Minnesota began its existence. In 1856 the first building was started on land donated by Regent Steele. The first legislative appropriation was $15,000 in 1867. From this time onward definite progress was made in the upbuilding of the University until today it is one of the largest institutions of higher learning in the United States.

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The original University Building as it [illegible]

History of the Department of Chemistry

Chemistry is the oldest science in the University in that it was the first to take definite shape as a department of study and research.

In 1869 chemistry was located in the original University building under supervision of Professor Twining, who is said to have been one of the most accomplished men ever held by the University. He taught all other sciences as well as mathematics and latin, later going into practical engineering. Stephen Peckham, who held the chair of chemistry from 1873-80, was the next man who devoted any considerable part of his time to teaching this science. Professor Peckham's successor was James A. Dodge, the first man to teach chemistry exclusively. His term of service was from 1880-93. Dr. George B. Frankforter came to the school as Professor of Chemistry and Director of the Chemistry laboratory in 1893. The advent of Dr. Frankforter may be regarded as the true founding of the School of Chemistry of the University of Minnesota.

The first complete course in chemistry was offered in 1894. Upon abandonment of the old School of Science and Mechanical Arts in 1897, chemistry went into the department of Science, Literature, and Arts, where it remained until 1904 when the separate and independent School of Analytical and Applied Chemistry was formed. Since that time, chemistry has had a Dean, an autonomous faculty, and the School has control of all courses leading to degrees in chemistry and chemical engineering.

In 1919 the title was changed to the School of Chemistry and the Dean became also Dean of Engineering and Architecture. Dr. S. C. Lind came to the University in 1926 as Director of the School of Chemistry, so that there is now a dual system, a Dean who controls the financial, statistical, and administrative features of the School, and a Director in charge of the scientific aspects of the department.

The Deans of the School of Chemistry have been; Dr. George B. Frankforter, 1904-18; Dr. Lauder W. Jones, 1918-20; the present Dean, O. M. Leland, 1920- , and Director S. C. Lind, 1926- .

In the early years of the chemistry department Analytical Chemistry was very prominent as is shown by it's inclusion in the departmental title until 1919. Because of the interest in cereals in the State of Minnesota, cereal chemistry attained early prominence, but in 1888 it was transferred to the Agricultural Experiment and Farm School, located two miles from the University proper, in St. Paul.

With the coming of Dr. Frankforter, Organic Chemistry came into the ascendency and Minnesota has been one of the strong centers of this Division ever since. Dr. Frankforter was succeeded during the War, in 1917, by Dr. W. H. Hunter, who is the present chief of the Division of Organic Chemistry. Dr. Hunter has always had an enthusiastic group of students in organic chemistry and the majority of Ph.D. degrees have been conferred in this Division.

The present Chief of the Division of Physical Chemistry is Dr. Frank H. MacDougall who came to Minnesota in 1915. The specialty of the division is thermodynamics.

Dr. C. A. Mann, Chief of the Division of Chemical Engineering, organized this division upon coming to Minnesota in 1919. This division has had an increasing prominence in the School of Chemistry since that time. The majority of undergraduates in the School of Chemistry now secure their B.S. degrees in Chemical Engineering.

The Division of General Inorganic Chemistry was organized as at present by Professor Lauder W. Jones. Dr. M.C. Sneed came to Minnesota with Dr. Jones to take charge of this division.

The Headship of Analytical Chemistry was vacated last year by the resignation of Dr. P.H.M.P. Brinton. Dr. I.M. Geiger has succeeded him temporarily in administrative capacity. Professor I. M. Kolthoff was called in the fall of 1927 from the University of Utrecht to a full-time Professorship in Analytical Chemistry.

The Division of Technological Chemistry is under the leadership of Dr. E.P. Harding. The specialty of this department is fuels, (liquid, solid, and gaseous).

In 1926 a new subdivision of Physical Chemistry was established in Photo and Radio Chemistry under the supervision of Dr. S. C. Lind.

The work of this Division is divided into three general classes; the chemical effects of electrical discharge, especially in gases, photochemical action, and the chemical effects produced by radioactive radiations. Dr. Lind states that a comprehensive title for this Division would be, "Chemical Activation."

In the very early periods rather meager space was devoted to chemistry along with the other sciences. For several years it was housed together with Physics in the building now occupied by the Minnesota Union.

The present building housing the School of Chemistry was dedicated in 1913. It is located on the Campus of Science, just above the banks of the Mississippi River. The building was originally planned by Dr. Frankforter. Due to insufficient funds the building was only three-fourths completed at that time. In 1919 the building was made a complete rectangle, (200 x 180 ft.), of four stories with a basement and sub-basement. The total floor space is about 175,000 ft. sq. It is perhaps the largest single unit building devoted entirely to chemistry in the United States. The construction is modern and fireproof throughout. The auditorium, seating over five hundred students, is located in a court in the center of the building and can be entered from three sides of the building. The auditorium is provided for front and rear projection and has a moving picture cabinet.

The Departmental Library, containing about 8,000 volumes, is situated on the ground floor. According to the Library Directory of Chemical Abstracts, it is among the most complete University Chemical Libraries in the country. All the principal periodicals of the world concerning chemistry are received. A trained Librarian is in attendance during the day, while in the evenings student caretakers are employed.

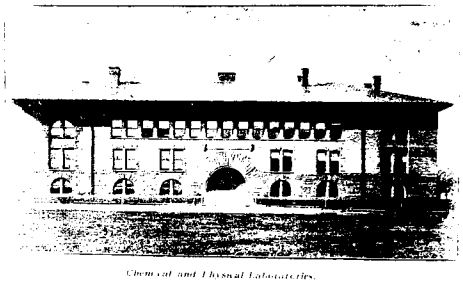
Stockroon service is maintained on three floors of the building, each stockroon being particularly organized for the work on that floor. A subterranean fume cellar for fuming, explosive or noxious chemicals has been constructed outside the building. This cellar is seventeen feet underground for the maintenance of a temperature never exceeding fifteen degrees centigrade. It is also connected to the sub-basement and has outside ventilation.

A view in the Library

The Chemical Laboratory.

The First Laboratory

In the Chemistry-Physics Building



An Early Building

A Present Research Lab

The Present Building of the School of Chemistry

A General Inorganic Lab

The Division of Agricultural Biochemistry and the Division of Soils and Soil Chemistry

The first chemist in the Department of Agriculture was David N. Harper who was appointed in1888, holding the position until 1902, when the late Professor Harry Snyder was appointed Professor of Agricultural Chemistry. Professor Snyder held this position until 1909, when he resigned. Ralph Hoagland was then appointed Professor of Agricultural Chemistry and Soils, holding the position until 1913, when he resigned to enter work in the Department of Agriculture at Washington.

Following Professor Hoagland's resignation, the work in chemistry was divided into two divisions, a Division of Agricultural Chemistry, and a Division of Soils and Soil Chemistry. Dr. F. J. Alway was named Chief of the latter Division, which position he still holds. Dr. R. W. Thatcher was appointed Chief of the former Division, the name of which was later changed to the Division of Agricultur al Biochemistry. Professor Thatcher held this position until 1917, when he was appointed Dean and Director of the Department of Agriculture at Minnesota. Dr. R. A. Gortner was named Chief in his stead, which position he holds at present.

The present staff of the Division of Agricultural Biochemistry consists of three professors, one associate professor, two assistant professors, and an assistant chemist

connected with the Experiment Station. The present staff of the Division of Soils and Soil Chemistry consists of one professor, one associate professor, two assistant professors, and one instructor.

A new building for the Division of Agricultural Biochemistry was opened this fall. The building and equipment cost approximately $250,000. The Division of Soils and Soil Chemistry now occupy the building formerly housing both Divisions.

The floor plan of the new building has been designed with special referance to research and teaching facilities. Graduate work in Agricultural Biochemistry has developed to a point where each year there are from twenty-five to thirty graduate students working for advanced degrees in this Division.

The new building is a four floor structure. The basement floor is devoted to semi-commercial processes and contains filter presses, autoclaves, etc. An optical room is available for physical chemistry and a large laboratory is devoted to cereal chemistry. There is a nitrogen room capable of handling forty-eight Kjeldahl determinations as a unit. The main floor is essentially a teaching floor with offices for the professors, lecture rooms and sophomore laboratories. The second floor is very similiar in construction except that it is for junior and senior students. The third floor is entirely for research. Two large

laboratories provide for thirty-two graduate students, each having sixteen feet of desk space. A large room is allotted for the graduate student's office and study, each student being provided with a desk. Two animal nutrition laboratories are also located on this floor.

One feature of the building is a room on the second floor where certain of the staff members can go and "be off the campus." It contains no telephone and anyone desiring to do intensive research may dissapear by going into the room and locking the door.

Dr. R. A. Gortner

New Home of Agricultural Biochemistry, University of Minnesota
C. H. Johnson, Architect

Physiological Chemistry

Physiologic chemistry is taught under the supervision of the Medical School. There are several courses in physiologic chemistry offered, as well as a course in pathological chemistry.

Dr. J. F. McClendon, Ph.D. from the University of Pennsylvania in 1906, has been head of this department since 1920. Dr. McClendon came to Minnesota in 1914 as a professor in the department of physiology.

For the past twenty years Dr. McClendon has been actively engaged in research work and at the present time is particularly interested in the electrical conductivity and capacity of living tissues. For this work he is using a Wheatstone bridge and pure sine wave current varying in frequency from 500 to 2,000,000 cycles per second. In such manner Dr. McClendon studies the resistance and capacity of the surface layer of living cells, which acts as a semi-permeable membrane.

Dr. McClendon has recently perfected a method for the determination of traces of iodine in foods. This method will be published in the Journal of the American Chemical Society in the March number.

A new calorimeter for the determination of the amount of heat produced by different kinds of food burned in the human body has been constructed by Dr. McClendon and he has also developed methods for the determination of hydrogen-ion concentration in the blood, urine and

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stomach contents by means of the Dubosoq colorimeter.

Dr. McClendon has published approximately fifty papers on hydrogen-ion concentration, alkaline reserve, iodine metabolism, vitamins, and the electrical conductivity of cells at high frequencies.

Dr. J. F. McClendon

Early Staff Members of the School of Chemistry

Dr. George B. Frankforter, Ph.D. from the University of Berlin in 1893, came to Minnesota as Dean of the chemistry department in 1893, continuing in that capacity until 1918. Dr. Frankforter continued as Professor of Organic and Industrial Chemistry until 1925 when he retired on the Carnegie Fund, as Professor Emeritus.

Dr. Frankforter directed and performed an immense amount of research, chiefly on alkaloids, narcotin, narcein, veratrin and isopyrion oils, the terpenes-including camphor

and crude pitch, eugenol, formaldehyde, the pitch of the northern pine, resins and mercury fulminates.

George B. Frankforter

Professor Charles F. Sidener came to Minnesota in 1893 as instructor in chemistry. He became professor of Analytical Chemistry in 1906, retiring as Professor Emeritus in 1923. Professor Sidener was chiefly interested in the determination of aluminum, phosphorus in vanadium steel and ferro-vanadium alloys, the separation of molybdenum from vanadium and the iodometric determination of vanadium.

Dr. F. C. Frary received all of his collegiate training at the University of Minnesota, receiving the Ph.D. degree in 1912. From 1907-11, Dr. Frary served as instructor in chemistry at Minnesota, becoming assistant professor in 1911 until 1915 when he resigned to become

research chemist for the Oldbury Electrochemical Company. In 1917 he became director of research of the Aluminum Company of America.

Dr. Frary carried out a number of important researches while at Minnesota, chiefly in photochemistry, metallurgy and electrochemistry.

Dr. Paul H. M. P. Brinton also received all of his collegiate training at Minnesota, receiving his Ph.D. degree in 1916. Dr. Brinton came to Minnesota in 1913 as associate professor of analytical chemistry, becoming Chief of this Division in 1921. Last year Dr. Brinton resigned to carry out private research investigations.

Dr. Brinton is noted for his work on the chemistry of the rare elements and the separation of the rare earth oxides.

Present Staff of the School of Chemistry

Dr. Samuel C. Lind, Ph.D. from the University of Leipzig in 1905, ~~from~~ studied the University of Paris in 1910, and ~~from~~ worked in the Radium Institute of Vienna in 1911, came to the University of Minnesota as Director of the School of Chemistry in 1926. Dr. Lind served as chemist in radioactivity at the U. S. Bureau of Mines from 1913-18, as physical chemist from 1918-23, and as chief chemist from 1923-25. In 1925-26, Dr. Lind was accociate director of the Fixed Nitrogen Laboratory of the U.S. Dept. of Agriculture.

Dr. Lind is noted for his research work on radio-activity, radium extraction and measurement, influence of radium radiation on chemical action, kinetics of chemical reactions, relation of gaseous ionization to chemical action and several phases of photo-chemistry.

Dean O. M. Leland, B. S., C. E., became head of the School of Chemistry and of the College of Engineering nad Architecture in 1920, which position he occupies at the present time. Dean Leland is particularly interested in the administrative, financial, and atatistical affairs of the two departments.

Dr. M. Cannon Sneed, Ph. D. from the University of Cincinnati in 1916, came to the University of Minnesota in 1918 as Head of the Division of Inorganic Chemistry.

In research work Dr. Sneed has been particularly interested in Beckmann's rearrangement of hydroxamic acids, methyl mercuric acetate and methyl mercuric hydroxide. Last year Dr. Sneed published a textbook of General Inorganic Chemistry.

Dr. Frank H. MacDougall, Ph.D. from the University of Leipzig in 1907, came to the University of Minnesota in 1915. Dr. MacDougall's specialty is thermodynamics. He is author of the well known text, "Thermodynamics in Relation to Chemistry", the second edition of which appeared last year. Dr. MacDougall has been particularly interested in research on reaction velocities, equation of state for gases, electrical conductance of non-homegeneous systems, and surface tension measurements.

Dr. William H. Hunter received all of his collegiate training at Harvard University, obtaining the Ph.D. degree in 1910. Dr. Hunter came to the University of Minnesota in 1909. Dr. Hunter is chiefly interested in reaction mechanisms, electro-organic chemistry and various synthetic problems.

Dr. Charles A. Mann received all of his degrees from the University of Wisconsin, receiving the Ph.D. degree in 1915. Dr. Mann came to Minnesota in 1919 as Chief of the Division of Chemical Engineering. Dr. Mann has published several research papers on the chemistry of saw palmetto berries and corn cobs, lead from sulfate residues, plating iron with tungsten, electrochemical oxidation of toluene to benzaldehyde, and the mechanism of lithopone formation.

Dr. F. J. Alway, Ph.D. from the University of Heidelberg in 1897, came to the University of Minnesota in 1913 and is now Head of the Division of Soils and Soil Chemistry. Dr. Alway has been particularly interested in the reduction of nitro compounds, hydroxylamino and nitroso compounds, the bleaching of flour, and various aspects of soils and soil chemistry.

Dr. E. P. Harding, Head of the Division of Technological Chemistry, received the Ph.D. degree from the University of Heidelberg in 1900. Dr. Harding has been a professor of chemistry at the University of Minnesota since that time. He is the author of several papers on the synthesis and reduction of aldazines, the synthesis and derivatives of hydrazones, sulfur in coal

gas, and benzene in illuminating gases.

Dr. I. M. Kolthoff came to the University of Minnesota in 1927 to assume a full professorship in Analytical Chemistry. His specialty is electrometric titrations and the theory of indicators. Professor Kolthoff is the author of a large number of publications in this field, including several books in German and English, two recent books being under joint authorship with Professor Furnam of Princeton University.

A Review of Some Contributions to Chemical Research from the University of Minnesota

Thyroxin

Dr. E. C. Kendall received the Ph.D. degree in chemistry from Columbia University in 1910. Dr. Kendall is Head of the section on chemistry of the Mayo Foundation and professor of biochemistry at the University of Minnesota. Dr. Kendall has conducted an immense amount of research in physiological chemistry, chiefly on the chemistry of the thyroid gland, the isolation and investigation of thyroxin, and oxidation in the animal organism.

Edward C. Kendall

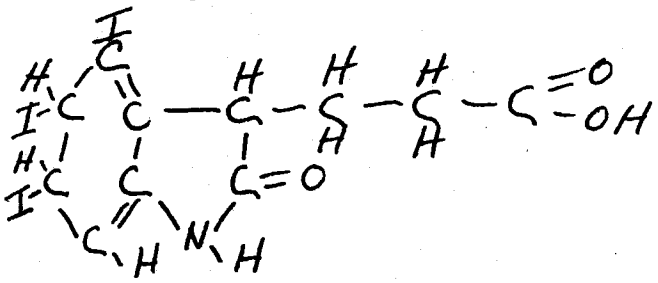
In 1914, Dr. E. C. Kendall isolated the iodine-containing compound of the thyroid gland and named it "thyroxin." By the use of this compound it has been shown in the Mayo Clinic and elsewhere that there is no symptom associated with thyroid deficiency which is not relieved in a manner exactly analagous with the use of dessicated thyroid gland. Cretinism and myoxedema are wonderfully relieved by an intravenous injection of pure thyroxin. This fact showed that thyroxin was the essential constituent of the thyroid gland.

The procedure for the isolation of thyroxin is a long and tedious one. Fresh thyroid glands from hogs are boiled in five per cent sodium hydroxide, the sodium salts formed precipitate out and the clear alkali liquid is cooled and acidified. The precipitate is redissolved in sodium hydroxide and reprecipitated with hydrochloric acid. This second precipitate is air dried and dissolved in ethyl alcohol. This liquid is almost neutralized, a heavy, tarry, black precipitate settles out and the mixture is filtered. The filtrate is treated with a hot water solution of barium hydroxide and refluxed. After refiltering, a small amount of sodium hydroxide is added and carbon dioxide passed through the mixture. After filtering the ethyl alcohol is distilled off and the solution acidified with hydrochloric acid. The precipitate is then redissolved in alcohol and the process repeated until on addition of sodium hydroxide, the sodium salt of thyroxin precipitates out. This substance is purified by a third

repetition of the process and the thyroxin is finally obtained in pure form after five or six precipitations with acetic acid.

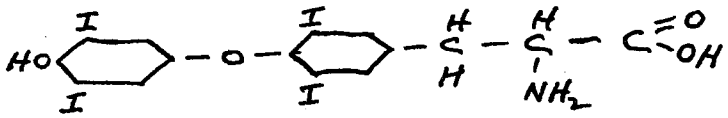
To obtain twenty grams of the pure crystalline material, Dr. Kendall worked eight years almost continously and used almost four tons of thyroid glands of hogs.

The tentative structure assigned to thyroxin by Dr. Kendall was:



4,5,6, tri-iodo-5,6, dihydro, 2, oxindole propionic acid

Basing his work on this formula, Dr. Kendall carried out an immense number of investigations on the chemical nature of thyroxin, synthesis of related compounds, and the chemical explanation of the physiologic action of thyroxin. This work will not be discussed here due to the recent work of Dr. Harrington, in England, who synthesized thyroxin and absolutely proved its formula to be:



This compound is indistinguishable chemically and physically from thyroxin and has exactly the same physiological action.

Dr. Kendall showed that thyroxin alone increases the rate of metabolism in the animal organism to such an extent that the injection of one milligram of the pure crystalline form produces an increase in the carbon dioxide output of approxiamtely 400,000 milligrams. Following the injection of thyroxin there are three distinct parts to the curve of response. Six to eight hours are required before the basal metabolism rate is affected. From that time forward there is a gradual increase but the maximal response is not reached until the eighth to tenth day following the injection. After this stage the metabolic rate slowly drops to the original level. This corresponds exactly with the time action of dessicated thyroid.

The action of minute amounts of thyroxin for long periods and the production of such enormous increases in the output of carbon dioxide, lead strongly to the conclusion that thyroxin acts as a catalyst. The function of thyroxin must therefore be the furnishing of a compound in the body that can be acted on by mild oxidizing agents and which can then by an intramolecular rearrangement produce an intensely active oxidizing substance.

The entire absence of the substance from the body does not produce death, but merely a lowering of the level at which energy can be produced in the body. Its catalytic function increases the rate at which these fundamental reactions are carried out.

Although Dr. Kendall failed to establish the true formula of thyroxin, the isolation of thyroxin and study of its physiological properties,(leading to a proper understanding of the function of the thyroid gland and its relation to health and vitality in the individual), is an outstanding contribution to the field of chemical research.

The Work of Dr. R. A. Gortner on the Origin of the Humin Formed by the Acid Hydrolysis of Proteins.

When proteins are subjected to hydrolysis by boiling acids, a blackening of the solution occurs, and upon boiling for some time, black, acid-insoluble particles separate from the solution. These black, insoluble particles are generally termed "humins."

Dr. Gortner began work on this subject before the year 1910. He believed that the nature of the mother substance from which these humins are formed was a fundamental field of research and he has continued work in this field to the present time.

the first protein used for this work was zein, from corn. When the zein was hydrolyzed alone the solution did not become intensely black but when tryptophane was added the color developed sooner and with greater intensity. When tryptophane is boiled with mineral acids in pure solution no humin is formed, but when tryptophane is added to a protein an abundance of the black substance is formed.

Histidine addition causes no increase in humin nitrogen, the histidine being quantitatively recovered from the humin. This led Dr. Gortner and his associated to believe that the humin nitrogen ~~of protein~~ of protein hydrolysis has its origin in the tryptophane neucleus. They therefore set about to prove this contention.

The next step in this work was the hydrolysis of proteins in the presence of formaldehyde in an attempt to find a possible condensation agent for the tryptophane. This hydrolysis showed a definite increase in the humin nitrogen. Tryptophane was boiled with acids in the presence of carbohydrates, practically all of the tryptophane being converted to humin nitrogen, a further proof of the conclusion reached in the first step of the research.

That a carbohydrate might cause the humin formation with a protein was disproved by the fact that it causes a sudden initial rise in humin nitrogen but further additions cause a much smaller rise, never reaching a maximum figure. The initial rise was very probably due to a chemical reaction augumented by adsorption and occlusion, the humin formed from the carbohydrate adsorbing or occluding the amino acids.

The next step in the work was to prove that amino acids other than tryptophane did not cause the humin formation. For this work, the proteins fibrin and gelatin were used. The gelatin contains no tryptophane and would not form humin on acid hydrolysis until tryptophane was

added, whereupon the black, insoluble precipitate was immediately formed. On further investigation, Dr. Gortner found that indole when substituted for the tryptophane caused the same reaction, thus indicating that it is the indole neucleus which causes the primary reaction.

Dr. Gortner now wished to find proof of the aldehyde condensation theory so he hydrolyzed fibrin and gelatin with tryptophane in the presence of formaldehyde, benzaldehyde, acetaldehyde, butyric aldehyde and iso-butyric aldehyde. All the above substances gave positive results as to humin formation but some error in regard to a direct action might be introduced by adsorption and occlusion due to polymerization. However, this data distinctly indicates a reaction between tryptophane and an aldehyde group to produce the insoluble humin.

Dr. Gortner did not consider such evidence conclusive enough to permit of a defintie statement of such a condensation actually taking place so he proceeded to further research on the problem.

To determine whether or not ketones play any part in the humin formation, fibrin was hydrolyzed alone and in the presence of acetone and acetophenone and in measuring the nitrogen distribution by Van Slyke's method it was seen that the ketones produced no added effect at all similiar to the action of an aldehyde on the same substance.

At the present time Dr. Gortner and his associates are further investigating the origin of the humin formed by protein hydrolysis although they have quite conclusively shown that the active constituent is the indole neucleus of tryptophane and that the mechanism of the reaction probably corresponds to an aldehyde condensation with the tryptophane.

The Work of Dr. L. H. Reyerson and Collaborators On Surface Catalysis

To produce the reducing gel, good, clear, silica gel was placed in a Pyrex glass tube and evacuated for three to four hours at a temperature of 400 degrees centigrade, and a pressure of less than one-one hundredth of a millimeter. While still evacuated the tube was cooled to a minus twenty degrees in a salt ice bath. Electrolytic hydrogen, specially dried and purified was then admitted under atmospheric pressure and allowed to remain in contact with the gel for at least thirty minutes.

The hydrogenated gel thus formed was found to reduce solutions of chlorides of copper, silver, gold, platinum and palladium, thus indicating the possibilities of the gel as a reducing agent.

As a result of this work Dr. Reyerson has patented processes for the preparation of catalysts comprising metal and silica gels. Adsorbed gases are removed from silica gel by the action of a vacumn and replaced by hydrogen as described above. This hydrogenated gel is then treated with a solution of a metal salt such as of copper, silver or platinum, for sufficient time to permit reduction of the metal

by the adsorbed hydrogen so that all the surfaces of the metallic silica gel are coated with a metallic film of ultramicroscopic proportions.

Platimum and palladium gels of this type were found to hydrogenate ethylene sixty-one percent at zero degrees and ninety-nine percent at ninety-five degrees. Using nickel as the catalyst at 180 degrees phenol was hydrogenated fifty to sixty percent to cyclohexanol. Aniline was hydrogenated to ammonia, one product being phenyl amino cyclo hexane.

These metallized silica gals can be used industrially for hydrogenating unsaturated oils or for the synthesis of ammonia.

Present Lines of Research at the University of Minnesota

In Organic Chemistry Dr. Hunter, Dr. Smith and Dr. Lauer offer work for advanced degrees. Dr. Hunter is interested in reaction mechanisms, taking as his point of entrance the oxidation of phenols and halogen substituted phenols and the oxidation of amines of the phenyl, tolyl and xylyl series. He has also a number of synthetic organic problems being carried out by graduate students. Dr. Hunter is interested also in the nature of quinhydrones and at present has several men working on various phases of absorption spectra and electrode equilibria.

Dr. Smith is interested in keto-enolic tautomerism and heterocyclic chemistry. At present he is working on duroquinone and derivatives of the polymethylated benzenes.

Dr. Lauer is preparing many pure compounds and determining their di-electric constants and moments of inertia.

There are at present fourteen candidates for advanced degrees majoring in Organic Chemistry.

In Physical Chemistry, Dr. MacDougall is chiefly interested in theoretical thermodynamics with particular reference to surface tension problems.

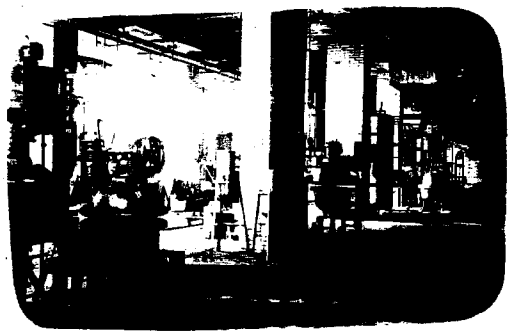
In Inorganic Chemistry, Dr. Sneed is interested in improving the qualitative scheme and Dr. Kirk is working upon co-ordinated compounds of hydrazones.

Dr. Taylor of the Physical Chemistry faculty has previously worked upon magneto chemistry but at present has a paint problem under way.

Dr. Brewer of the Technological Division has just found a quick and reliable method for the determination of hydrogen ion concentrations by means of standard electrodes.

In the Division of Chemical Engineering, Dr. Montonna has many phases of cellulose chemistry under investigation and Dr. Montillon is working upon problems of continuous crystallization of inorganic salts and the electroplating of chromium.

The School of Chemistry is especially well equipped for carrying out researches in the chemical effects of electrical discharge through gases including high voltage and high frequency equipment. One result of this work during the past year has been the discovery that liquid hydrocarbons can be obtained from the lower saturated members of



Views in the Chemical Engineering Division

the series, such as ethane, by means of electrical discharge. The molecular weight, density, and other properties of these liquid products varies through a range all the way from extremely volatile products similiar to petroleum ether up to viscous liquids similiar to lubricating oils, on up to solids. Very recently a method has been discovered for controling the molecular weight of these liquid products from 100 up to 467 in molecular weight. This work is being carried out under the direction of Dr. Lind by Dr. George Glockler, Research Associate of the American Petroleum Institute.

Dr. Bernard Lewis, Research Fellow of the National Research Council is working at the University of Minnesota in the field of photo-chemistry. He has proved recently in the case of hydrogen iodide, that decomposition of a mol ~~of~~ cubic of this substance can be accomplished by the absorption of a single quantum of ultra-violet light.

In the Division of Agricultural Biochemistry, the various projects being investigated at present are:

(1) Wheat and wheat flour studies involving a study of colloid behavior, respiration of grain, the chemistry of milling and baking, fermentation in relation to baking, the chemistry and physiology of yeast, etc. Dr. Bailey, editor of Cereal Chemistry, is particularly interested in this work.

(2) Protein studies involving methods of analysis, synthesis and physical properties of proteins. Dr. Gortner is primarily interested in this field and in the colloidal behavior

of proteins. The colloid Symposium which is in press at the present time has an extensive paper on, "Proteins and the Lyotropic Series", by Dr. Gortner and co-workers. An extensive manuscript has been accepted for publication in the Journal of Physical Chemistry dealing with the technic of measuring the absolute value of the electrical charge on the surface of solid colloid material, in this case cellulose, in which Drs. Gortner and Hoffmann point out that the generally accepted technic is not adequate for the problem. New apparatus and formulas have been developed for accurate work.

(3) Plant disease projects involving a chemical study of various fungi and their effect upon the host plants. Dr. Willaman is particularly interested in this line, and in certain technical aspects of industrial chemistry such as hydrogen ion control in pulp and paper manufacture, and also the various factors influencing the manufacture of syrups on a commercial scale. At the present time Dr. Willaman is on Sabbatic leave, studying in Professor Schryver's laboratory in London.

(4) Dairy chemistry problems and nutrition studies. Drs. Palmer and Kennedy are doing extensive work on these subjects and recent issues of the Journal of Biological Chemistry have contained papers by these professors. These papers indicate rather defintiely that an adequate synthetic diet cannot be prepared from pure protiens, salts and the known vitamins. Indications are that there are more than

the known vitamins necessary for adequate growth and nutrition.

There are approximately twenty-five graduate students doing major work in this Division. Five doctorates were granted in Agricultural Biochemistry last spring and two more since that time. A number of Ph.D. degrees will be granted this spring.

In the Division of Physiologic Chemistry, several students are assisting Dr. McClendon in the work on electrical conductivity and capacity of living cells, in the operation of the new heat calorimeter, and on the basal metabolism of children of measured surface area. Dr. Raymond Gregory of this section is working on bile salts.

Interesting and Predominant Features of the School of Chemistry of the University of Minnesota.

Some interesting and predominant features of the University of Minnesota School of Chemistry are:

(1) The combination of a Dean in charge of administrative work of the School, including student's grades, records, conduct, etc., and a Director who is in charge of the scientific work of the School and who also offers graduate courses.

(2) The inclusion of Chemical Engineering is regarded as an advantage of the School of Chemistry.

(3) Although advanced courses in Bio-chemistry, Physiologic Chemistry and Colloid Chemistry are taught outside the School of Chemistry, all basic courses are given within the School.

(4) The University of Minnesota combines on its two campuses in Minneapolis and St. Paul within three miles of each other all work of University rank which is supported by the State, including Agriculture, Mining, etc. This gives the School of Chemistry close contact with these related subjects. Members of the School of Chemistry are regular attendants of the Physics Colloquium and present papers in regular turn.

(5) A general Chemical Colloquium for the entire School of Chemistry is held every two weeks for the purpose of presenting papers on current research within the School.

(6) Weekly Seminars are held by the different Divisions.

(7) Summer School consists of two terms of six and five weeks respectively. The sum of the two is equivalent to one of the three quarters into which the regular school year is divided.

Special features of the present work and equipment of the School of Chemistry may be listed as follows:

(1) The School of Chemistry has the largest quantity of radium in the U.S. being devoted to scientific work. Most of this radium is being used to supply radium emanation for researches of graduate students and members of the staff on the effect of radon on gaseous and other chemical reactions.

(2) The laboratory of chemical manufacutre in the basement is unusually well equipped in the unit process system.
(3) The Department is very well equipped with dark rooms and has all facilities for spectroscopic and photochemical work, including a quart spectrograph.

The number of students registered in the School of Chemistry for 1927-28 is 224. The present academic enrollment in the University is about 10,500. The present enrollment of the Graduate School is about 1,100. The enrollment of the University has been growing steadily. Last year it was the fourth institution in the United States in size. If all classes of students including those in extension work, the Farm School, etc., be counted, the enrollment would be well over 20,000. Chemistry is taught anually to about 2,300 students. Most of these are, of course, from other departments such as the School of Medicine, the School of Engineering, Dentistry, Mining, agriculture and various others. One point of interest is that no student in Medicine is allowed to graduate without having had both lecture abd laboratory courses in Physical Chemistry and Quantitative Analysis and the prerequisite courses.

The system of employing teaching assistants is on the basis of a maximum of twelve hours of instructional work per week, the balance of the time to be devoted to graduate study and research. The assistants must possess the bachelors degree and be candidates for the master's or doctor's degree. The compensation is $650 to $750 for the academic

year, including remission of all fees. The requirements for advanced degrees are very similiar to those adopted by other like institutions.

Among distinguished graduates of the University of Minnesota may be mentioned, among others, Professor Farrington Daniels, of the University of Wisconsin, Dr. F. C. Frary and Mr. Julius Edwards of the Aluminum Company of America, Dr. Russell S.McBride of Washington, D.C., Dr. James Doran, the present head of the prohibition administration, Professor P.H.M.P. Brinton, recently resigned from the chemistry staff, Dr. C.H. Hamilton of the Medical Research Department, Detroit, Mich., and Mr. V. M. Kokatnur consulting chemist of the DuPont DeNemours Company.

CURRICULA—CHEMISTRY

OUTLINES OF CURRICULA

The required courses in each curriculum in this college are listed below with the quarters in which they regularly occur. In addition, the necessary number of approved elective courses must be taken to complete the requirements for the separate degrees.

CHEMISTRY AND CHEMICAL ENGINEERING

REGULAR FRESHMAN YEAR

For students satisfying the requirements of algebra, solid geometry, and chemistry.

Fall	Credits	Winter	Credits	Spring	Credits
M. & M. 11	5	M. & M. 12	5	M. & M. 13	5
Inorg. Chem. 9	5	Inorg. Chem. 10	5	Inorg. Chem. 12	5
English 4	3	English 5	3	English 6	3
Drawing 4	2	Drawing 5	2	Drawing 6	2
M.E. 12, 13, or 17	2	M.E. 12, 13, or 17	2	M.E. 12, 13, or 17	2
Mil. Sci. 2	0	Mil. Sci. 2	0	P.H. 2	0
				Mil. Sci. 3	0

REGULAR SOPHOMORE YEAR

Fall	Credits	Winter	Credits	Spring	Credits
M. & M. 24	5	M. & M. 25	5	M. & M. 84	5
Inorg. Chem. 13	5	Anal. Chem. 1	5	Anal. Chem. 2	5
Physics 3	3	Physics 23	3	Physics 43	3
Physics 4	1	Physics 24	1	Physics 44	1
German 24	4	German 25	4	German 26	4
Mil. Sci. 4	0	Mil. Sci. 5	0	Mil. Sci. 6	0

CHEMISTRY

JUNIOR YEAR

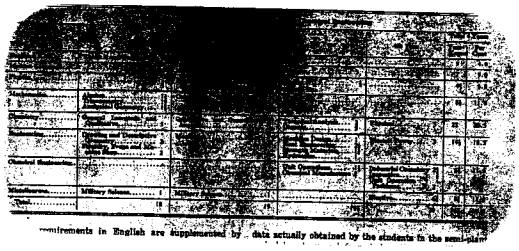
Fall	Credits	Winter	Credits	Spring	Credits
Org. Chem. 51	5	Org. Chem. 52	5	Org. Chem. 53	5
Anal. Chem. 123	3	Anal. Chem. 124	3	Phys. Chem. 103	5
Phys. Chem. 101	5	Phys. Chem. 102	5	German 29	3
German 27	3	German 28	3	Physics 33	2
				Inorg. Chem. 51	0
				Inorg. Chem. 52	0
				Anal. Chem. 53	0

SENIOR YEAR

Fall	Credits	Winter	Credits	Spring	Credits
Chemistry 96	5	Chemistry 97	5	Chemistry 98	5
Tech. Chem. 100	3	Tech. Chem. 101	3	Tech. Chem. 102	3

Together with 34 elective credits, 15 of which must be in Chemistry.

CURRICULA—CHEMICAL ENGINEERING



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BIBLIOGRAPHY

SCHOOL OF CHEMISTRY

Faculty and Staff

Administration

Lotus Delta Coffman, Ph.D., L.L.D., President

William Watts Folwell, L.L.D., President Emeritus

Cra Miner Leland, B.S., C.E., Dean of the School of Chemistry and the College of Engineering and Architecture

Samuel Colville Lind, Ph.D., Professor of Chemistry and Dean of the School of Chemistry

Inorganic Chemistry

M. Cannon Sneed, Ph.D., Professor and Chief of the Division

Lillian Cohen, Ph.D., Assistant Professor

Raymond E. Kirk, Ph.D., Assistant Professor

Norville C. Pervier, Ph.D., Assistant Professor

Lloyd H. Reyerson, Ph.D., Associate Professor

Henry N. Stephens, Ph.d., Assistant Professor

Hervey H. Barber, Ph.d., Instructor and Supply Superintendent

Gladstone B. Heisig, M.S., M.A., Instructor

J. Lewis Maynard, B.A., Instructor

Analytical Chemistry

I. William Geiger, Ph.D., Professor and Head of the Division

I. V. Kolthoff, Ph.D., Professor

Charles F. Sidener, B.S., Professor Emeritus

Landon A. Sarver, Ph.D., Assistant Professor

BIBLIOGRAPHY

Organic Chemistry

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George B. Frankforter, Ph.D., Professor Emeritus

Lee I. Smith, Ph.D., Assistant Professor

Walter M. Lauer, Ph. D., Assistant Professor

Physical Chemistry

Frank H. MacDougall, Ph.D., Professor and Chief of Division

Nelson W. Taylor, Ph.D., Assistant Professor

Technological Chemistry

Everhart P. Harding, Ph.D., Associate Professor

Arthur E. Stoppel, Ph.D., Assistant Professor

Ralph E. Brewer, M.S., Instructor

Chemical Engineering

Charles A. Mann, Ph.D., Professor and Chief of the Division

George H. Montillion, Ph. D., Associate Professor

Ralph E. Montonna, Ph.D., Assistant Professor

Fellows

Irvin Lavine, B.S., (Ch.E.), DuPont

Grace M. DeVancey, B.S., (Chem.), Shevlin

Lester L. Johnson, B.S., (Ch.E.), Research Fellow in the Engineering Experiment Station

BIBLIOGRAPHY

Staff of the Division of Agricultural Biochemistry

R.A. Gortner------ Chief and Professor
C.H. Bailey ------ Professor
L.S. Palmer ------ Professor
J.J. Willaman-----Associate Professor
Cornelia Kennedy--Assistant Professor
W.M. Sandstrom----Instructor
W. B. Sinclair----Instructor
K.W. Franke-------Instructor
G.S. Taylor-------Instructor
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R.C. Sherwood-----Assistant Professor

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P.R. McMiller-----Assistant Professor
G.H. Nesom--------Assistant Professor
Constantine Nikiforoff---Instructor

Staff of Physiologic Chemistry

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Dr. Pettibone-----Professor
Dr. Gregory-------Professor

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