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OF

JULIUS STIEGLITZ

1867–1937

BY

WILLIAM ALBERT NOYES

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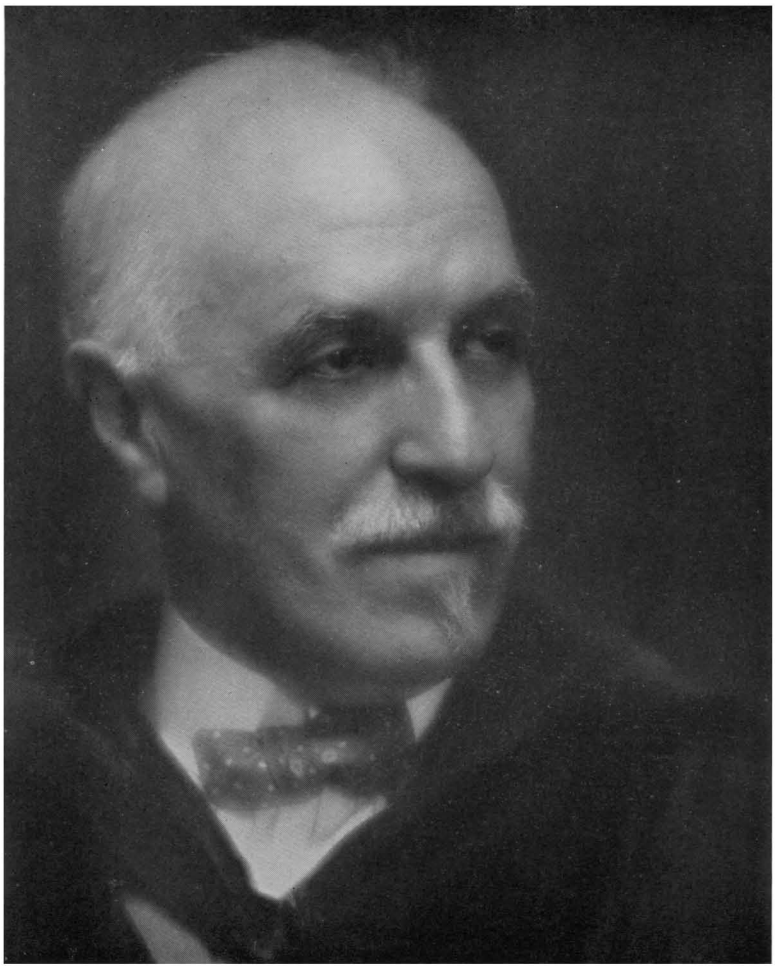

Julius Stieglitz

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1867–1937

BY WILLIAM ALBERT NOYES

Edward Stieglitz, the father of the subject of this sketch, was born in Gehaus, Thuringia, Germany but spent most of his life in Hoboken, New Jersey, and in New York City. He was an importer of woolen goods and notable for his integrity and high ideals. At one time a letter from the west was directed "To the most honest man in New York City". It was given to Edward Stieglitz. It was in the home of such a man that Julius Stieglitz acquired that sterling honesty which was one of his characteristics to every one who knew him. Neither Edward nor his wife, Hedwig Werner Stieglitz, had extensive academic training. Professor Adolph Werner, the mother's cousin, taught German at the City College, New York. He was a great teacher who loved young people and labored in their interest. There were also Rabbis and other professional men on the mother's side.

Julius and his identical twin, Leopold, were born in Hoboken, N. J., May 26, 1867. Before he was fourteen Julius studied the violincello in New York and later continued the study with Lindner, a noted teacher, at Karlsruhe. His twin brother Leopold played the violin. Julius always retained a great love for music and for the opera.

The twins attended kindergarten in New York City and after that the public schools until they were prepared for the examinations for entrance to the City College of New York. After the boys had passed these, their father interrupted his business activities and took the boys to Europe where they entered the Realgymnasium in Karlsruhe, in 1881, on the basis of their examinations to enter City College.

Before taking the boys abroad the father asked advice regarding professions currently important for young men. He was

* The name Julius (Oscar) Stieglitz is given in Who's Who in America and in American Men of Science, but while the name Oscar must have been given him by his parents, he always disliked it and never used it, and it does not appear in scientific literature. These facts justify its omission from the title of this sketch and also justify the request that it shall not be used in referring to Professor Stieglitz.

told, "engineering and chemistry". Julius was attracted to medicine but when his twin brother, Leopold, chose that profession he preferred to follow a different line and chose chemistry. After preparation at the Realgymnasium he entered the University of Berlin and received the degree of Ph.D. in 1889 at the age of twenty-two.

Summers at Lake George were an important item in his life. The family began to go there in 1874 when Julius was seven years of age. While Julius was in Europe his father purchased an estate, Oaklawn, the larger part of which still remains in the hands of the Stieglitz family. This is a gathering place where they maintain a closely knit family life. Here there was developed a delightful home atmosphere presided over by the gracious, cultured mother, who kept "open house" for artists, authors, musicians and many others who came and went freely. In these surroundings Professor Stieglitz spent many summers after his return from Europe.

These conditions not only compensated the father and mother, in large measure, for the educational facilities they had missed in their youth but also gave to Julius Stieglitz and to his brothers and sisters that broad human culture and sympathy which have enabled them to contribute so much to the progress of our country in many and various directions.

Julius Stieglitz married Anna Stieffel at Lake George, New York, August 27, 1891. She was born in Constance, Baden, Germany, August 28, 1858 and spent her early life in Constance and Karlsruhe. Dr. Stieglitz and Anna Stieffel Stieglitz had three children. Flora Elizabeth was born at Chicago, Illinois, August 10, 1893, but died the following day from injuries received at birth.

Hedwig (Jacobin) was born at Chicago, April 16, 1895. She was educated at the University of Chicago and Rush Medical College. She has served as a health officer in Hammond, Indiana, and is practicing there as an oculist with her husband, Dr. Hugh Alva Kuhn, whom she married March 27, 1920.

Edward (Julius) was born in Chicago, June 6, 1899. After graduating from Rush Medical College he was a National Research Fellow in Medicine. Following this he was an assistant clinical professor in Rush Medical College and was active in

medical research. He also practiced medicine in Chicago. In 1938 he resigned his position in Rush Medical College and gave up his practice to accept a position in Washington as Medical Adviser to the U. S. Department of Labor.

The following extract from the biographical sketch by Dr. McCoy throws a very pretty sidelight on the home life of Dr. and Mrs. Stieglitz.

"One of the strongest traits possessed by Dr. Stieglitz was his love for children. His solicitous care led to such precautions that the family became known in university circles as the 'sterilized Stieglitzes'.

"I shall never forget an incident that illustrates this point. It happened at a departmental picnic on the shore of Lake Michigan. One of the ladies had washed a lot of fine strawberries, brought by Mrs. Stieglitz, in water dipped from the lake and mentioned the fact to Mrs. Stieglitz. At this that good lady threw up her hands and sighed, 'Ach! Du lieber Gott. I had carefully washed them in *distilled* water at home; now the children must get along without strawberries.' To this the children, now both doctors of medicine added, 'and we children caught everything that went the rounds!' "

Anna Stieffel Stieglitz died in Chicago, December 25, 1932.

Professor Stieglitz married Mary M. Rising, then associate professor in chemistry in the University of Chicago, August 30, 1934, in Chicago. She was born July 21, 1889 at Ainsworth, Nebraska.

In June 1932 Dr. Rising had adopted a baby who was born June 1, 1932 and was named Katharine Menardi Rising. After the marriage of Professor Stieglitz and Miss Rising, Professor Stieglitz adopted the child and her name is now Katharine Menardi Stieglitz.

The following true characterization of Professor Stieglitz is copied, with permission from the News Edition of Industrial and Engineering Chemistry for January 20, 1937.

"On January 10 at 7 A.M. Julius Stieglitz died in the calm imperturbability that many will recall as impressively characteristic of him.

"If it be true, as some have maintained, that his deliberation of speech and equanimity of manner were evidences of rigid self-discipline rather than the manifestation of natural disposition, it is but the more remarkable that his life should have been so consistently and his death so magnificently, in character.

"Yet his career of nearly three-score years and ten was one of intense and fruitful activity. The unruffled calm of Julius Stieglitz was as deceptive as that of the confident, skilled, and highly trained athlete, whose sense of timing and coordination and whose superb efficiency of motion enable him to accomplish, without haste and without apparent effort, feats which lesser men vainly pant and strain to equal. His lectures were typical of his mode of action, for their tempo was apparently leisurely: yet such was their economy and precision of statement and their logic of organization that he could present in an hour an exposition for which many lecturers would have found double the time none too much.

"All chemistry was his province. Self-taught in physical chemistry, he applied its principles to the elucidation and improvement of the methods and technics of qualitative analysis, and developed the textbook that became the classic in this branch of instruction.

"In his major field of interest, organic chemistry, he applied the same breadth of knowledge and displayed the same intensity of intellectual curiosity. His theory of indicators, his correlation of chemical structure with color, his investigations of molecular rearrangements and of chemical equilibria, are all permanent landmarks in the progress of the science. To him every problem, every unexplained phenomenon, every apparent anomaly was a personal challenge. He had the profound respect for fact that every scientist must have, but he had moreover the dissatisfaction with bare fact in itself that is the mark of the great scientist. Beyond the fact he sought its antecedents, its consequences and implications, its corollaries.

"This habit of mind left its imprint not only on his own work, but upon his students. Only a clod could have listened to his quiet, unemotional exposition of chemical themes without sensing the enthusiasm and the curiosity that were none the less evident for being undemonstrative.

"Broad as was the range of his chemical knowledge, and numerous as were his chemical achievements, they did not circumscribe his field of interest nor exhaust his capacity for creative work.

"With his twin brother, Leo, who entered medicine as a profession, he had always shared an enthusiasm for that profession. That his medical scholarship extended beyond mere dilettantism is attested by the fact that he was for more than twenty years vice chairman of the Council of Chemistry and Pharmacy for the American Medical Association, that he served as chairman of the National Research Council's Committee on Synthetic Drugs, and that he was for many years prior to his death a con-

sultant for the United States Public Health Service. He both edited and contributed to works designed to acquaint the educated public with the service that chemistry has rendered to medicine.

"With his elder brother, Alfred, the well-known photographic artist, he shared a liking for the camera, and many of his prints might well excite the envy of professionals.

"He found time for both sports and music and he played the cello well enough that his listeners might share his pleasure in it.

"The achievements and accomplishments of Julius Stieglitz and many honors and responsibilities conferred upon him are all matters of record. Of the personality that was Julius Stieglitz it is more difficult to convey a true impression to those who did not know the man intimately. The casual or nonperceptive observer never saw the real Julius Stieglitz.

"It may be that some mistook the air of preoccupation that was his shield against trivialities for professional absent-mindedness. If so, they deceived themselves, for Professor Stieglitz knew all that he cared to know of what went on around him. Indeed, he often knew what was going on in quarters that one would have thought lay beyond the range of his physical perceptions at the moment.

"His public manner often gave the impression of coolness and reserve and it is true that when the occasion demanded he well knew how to wear the mantle of the Herr Geheimrath. To those who sought his aid and advice, however, he invariably displayed the charm and courtesy attributed to southern gentlemen of the old school. He paid those who bespoke his criticism the compliment of speaking frankly. He never saved himself the trouble of framing a constructive suggestion by turning aside a sincere request for comment with a meaningless compliment. Yet his frankest criticisms were tempered with sympathy and were accompanied by sound counsel. His generosity was boundless, and it included his time, thought and effort. We shall not soon see his like again."

The father and mother of Professor Stieglitz were Hebrews but both his first and second wife were Protestants. When he was a young man he read and studied the New Testament carefully and thought it embodied the best philosophy and way of life. One of his friends to whom the first draft of this section was submitted has written that on numerous occasions he said to him "that his greatest joy in life was to help other people".

Lessing in his drama "Nathan der Weise" represents the judge as saying to the three sons who were typical of Judaism,

Christianity and Mohammedanism and who had received identical rings from their father,

"let each one aim
To emulate his brothers in the strife
To prove the virtue of his several ring
By offices of kindness and of love,
And trust in God."

I am sure that Professor Stieglitz was in close sympathy with the words of Lessing. He had a simple religious faith but often said when discussing some religious question, "I do not know".

He did not accept the sectarian doctrines of either Jews or Christians. He certainly rejected the belief of some Christians that the death of Jesus was a sacrifice for the sins of the world. In discussing religious questions with his friends he was always careful to avoid saying anything which would hurt their religious convictions.

The words "Jew" and "Gentile" were distasteful to him.

His parents were German but during the war he supported the government as a patriotic American citizen. He once said to me "I can never forgive the Prussians for what they have done to Germany".

He was a member of the National Research Council and studied hypnotics, novocaine and arsphenamine as war problems. He often visited Edgewood Arsenal for conferences on munitions.

He would have suffered greatly over the fate of Germany. He prophesied part of it when the treaty of Versailles was made. His sympathy was usually with minorities when they needed sympathy. The present state of the Jews would have grieved him greatly. He certainly would not have accepted Hitler's interpretation of Christianity.

When Stieglitz began his work for a Ph.D. dissertation under the direction of Professor Tiemann in Berlin the latter suggested a study of the action of diazobenzene chloride on benzamidoxime, $C_6H_5C \leqslant \begin{matrix} NOH \\ NH_2 \end{matrix}$. As the amidoxime has the properties of an amine, they expected a coupling reaction in which a diazoamino compound would be formed. Instead of this the oxime group was removed from two mols of the amidoxime in the form of

nitrous oxide and the residues formed a cyclic compound with the elimination of ammonia. The same result was obtained when other diazo compounds or an oxidizing agent were used.

The cyclic condensation product and the elimination of ammonia were emphasized in the title of the dissertation. An article was published in Ber.d.Chem.Ges. in which the use of the diazo compound was mentioned and the demonstration of the structure of the cyclic compound was developed. The first part of the dissertation contained an exhaustive and scholarly discussion of other condensations of amides with the elimination of ammonia. This is worthy of mention because many of the compounds mentioned in the dissertation were subsequently studied by Professor Stieglitz and his students at the University of Chicago.

After receiving his degree at Berlin, Stieglitz worked for a short time with Victor Meyer at Göttingen. Returning to America he spent a few months as a scholar at Clark University, having been attracted by the brilliant work of John Ulric Nef. In 1890-92 he spent two years in the laboratories of Parke, Davis and Co., in Detroit. His work was chiefly in toxicological analysis. Since the results of his work might lead to the indictment and conviction of a murderer, he felt the responsibility of his tasks very keenly and the occupation became very distasteful to him. He resigned in 1892 with the intention of entering academic work.

In 1892 he was offered a position in the College of the City of New York but, in spite of the fact that he had been married in 1891, he chose to go to the University of Chicago with a very small income.

At the University of Chicago he was advanced as follows:

1892-93—Docent.
1893-94—Assistant
1894-97—Instructor
1897-1902—Assistant Professor
1902-05—Associate Professor
1905-33—Professor
1912-24—Director of University Laboratories
1915-33—Chairman of the Chemistry Department
1933-37—Professor Emeritus

Professor Stieglitz received the honorary degree of Sc.D. from Clark University in 1909 and the degree of Chem.D. from the University of Pittsburgh in 1916.

Professor Stieglitz was awarded the Willard Gibbs Medal in 1923.

He was Hitchcock lecturer at the University of California in 1909; Dohme lecturer at Johns Hopkins University in 1924; Fenton lecturer at the University of Buffalo in 1933; lecturer at the Centenary of the Franklin Institute in 1925.

He was one of the Associate Editors of the Journal of the American Chemical Society 1912-19.

He was a member of the National Academy of Sciences; of the American Philosophical Society; of the American Academy of Arts and Sciences; of the American Association for the Advancement of Science, Vice President in 1917; of the American Chemical Society, President in 1917; of the Washington Academy of Sciences; President of Sigma Xi, 1917-19; a member of Soc. Chimique de France.

Member of the Board of Editors of the Scientific Monographs of the American Chemical Society 1919-36; member of the international commission for the Annual Tables of Constants; President of the Chicago Institute of Medicine 1918; vice-chairman of the council on chemistry and pharmacy of the American Medical Association 1902-24, member of the chemical division of the National Research Council 1917-19; chairman of committee on synthetic drugs 1917-19; vice chairman of the division of chemistry 1919-21; special expert of the U. S. Public Health Service 1918-36.

In the Journal of the American Chemical Society, *60,* Proc. 3 (1938) Herbert N. McCoy has published a very excellent biography of Professor Stieglitz. With his permission and that of the editor of the Journal, I copy the following extracts about which he has intimate personal knowledge that I do not have.

"The record of achievement in research marks Stieglitz as one of the strong men of his time. In addition to splendid teaching and high class research, he carried on other activities of great importance both to his university and to the nation.

"It was no part of Stieglitz' philosophy that teaching, research, and the writing of textbooks should constitute all of one's duties as professor. His horizon had a much wider scope and not many

years had passed before he took an active part in faculty matters. His thorough investigation of the questions involved, his logical and forceful presentation of their significance, and his fairness to both sides soon were recognized. He soon became a key man whose advice on university affairs was eagerly sought; his was the guiding influence in many committees. I will mention only two instances of the many where his services were of great value; and, in later years, there was scarcely an important question about which he was not consulted.

"Of his many memorable achievements, one was that concerned with the conflict between science and the classics. In the early nineties Chicago in common with most other colleges still adhered to a rigid requirement of the classics as a prerequisite for the bachelor's degree even for science students. This inheritance from medieval times was becoming very irksome to the students in physical and biological sciences. The preceding twenty years had witnessed amazing and unprecedented developments in natural philosophy which had now become a group of experimental sciences with seemingly unlimited possibilities. To be required to thumb through musty tomes of Latin and Greek when so much of greater interest and practical value was at hand seemed, to science students, a sacrilegious waste of time. The battle for the removal of this restriction waxed long and hard; Stieglitz was the leader for the cohorts of science.

"In the department of chemistry at Chicago, Stieglitz' students commemorated the ultimate triumph of the science group by presenting him with a parchment scroll expressing their gratitude for his untiring efforts in their behalf; the names of many who have since risen to prominence are appended.

"For one without special training in the subject, Stieglitz was outstanding among his colleagues for having a remarkable knowledge of medicine. This interest arose in early life and doubtless would have led him into that profession but for reasons already mentioned. Perhaps, also, the fact that Mrs. Stieglitz was afflicted with asthma for long years, and that their first child had died at birth and the other two had passed through numerous contagious ailments had much to do with the strengthening of this interest.

"It seems natural then that in 1901 when President Harper in his desire for a medical school at Chicago began to strive for a union with Rush Medical College as a means to this end, Stieglitz should find a place on the committee of which the late Dr. H. H. Donaldson was chairman.

"With only $50,000 in sight, Harper proposed to begin in a modest way by transferring to the university campus the work of the two preclinical years. After a memorable conference of

President Harper with the combined committees of the two institutions, in which ways and means were thoroughly discussed, Stieglitz asked Dr. Ingals, treasurer of Rush, the critical question he long had had in mind; that was, whether the tuition fees of the transferred students would revert to the university. When Ingals replied in the affirmative, Stieglitz saw at once that with this additional income the union so greatly desired by the University could be safely made with the $50,000 available. Harper was equally quick to grasp the situation and, in his characteristic fashion, changed the subject immediately and quickly brought the conference to a close. On the way out he said privately to Stieglitz, 'Mr. Stieglitz, let me have your budget by next Saturday morning.'

"Stieglitz had already worked out the details, but to avoid any serious blunders he and Dr. Donaldson made a hurried visit to four leading eastern medical schools, prospectuses of which they had studied. They returned convinced that with the laboratories and staffs at the university, together with the modest sum the president had mentioned as being in sight, they could offer facilities equal or superior to those of the schools they had visited.

"The union of Rush and the university was soon consummated and proved successful from the start. The hitherto nearly empty Hull laboratories were filled with medical students. The departments of anatomy, physiology, pathology, physiological chemistry, and bacteriology became realities instead of mere names, and suddenly took on new life.

"The union with Rush was looked upon by Stieglitz as a vital transfusion of blood into all science departments. He was justly proud of the part he had played in helping to lay the foundation of a great medical institution now a part of the university.

"After the premedical courses had been brought to the university the deanship of the new division was offered to Dr. Stieglitz by President Harper. The former with characteristic farsightedness begged to decline the honor and pointed out to the president that he considered it a better policy to put a Rush medical professor in the deanship.

"Stieglitz' close association with physicians and surgeons during the period of negotiations with Rush Medical College led to lifelong friendships with many leading medical men. This was the beginning of his affiliation with the American Medical Association that lasted officially two decades but actually existed throughout his lifetime. In 1905 he became vice-chairman of the powerful Council of Pharmacy and Chemistry, a responsibility he held until 1924. A record for the year 1920 showed Stieglitz' name on five of the fourteen committees of the Council.

"Dr. Leech, present secretary of the Council, commenting on Stieglitz' services to the American Medical Society says: 'It is proof of his fine judgment and parliamentary ability to note that the rules are essentially the same today as thirty-two years ago. He took great pains in seeing that every safeguard was put in the rules for impartiality of decisions.

" 'In his capacity as vice-chairman of the Council Stieglitz exerted a powerful influence on its action during the nineteen years of his tenure of office.'

"The summer of 1914 marked the beginning of the most critical period for chemistry in America. The British blockade that quickly followed the beginning of the World War shut off importation from Germany and thus soon produced a dearth of the previously imported fine chemicals so necessary for medicine and industry. The situation threatened speedy disaster. In the decade that followed Stieglitz played a conspicuous part among the army of loyal chemists whose efforts proved successful in this emergency.

"On January 1, 1917, Dr. Stieglitz became president of the American Chemical Society. The war was now in the middle of its third year. Three and a half months later America joined the cause of the Allies. As never before, war had developed into a conflict of chemists. Few officers of the society faced graver tasks than did Stieglitz and none deserves greater credit than he for his unselfish services in aiding in the stupendous developments that finally brought relief to medicine and industry and chemical independence to America. His notable success was due not only to his sound and extensive knowledge of organic chemistry, to his love of the science and art of medicine, to his deep interest in synthetic drugs, as evinced by his long service on the Council of Pharmacy and Chemistry of the American Medical Association; but, in no small measure, to his subsequent election or appointment to leading positions in organizations where his opportunities for acquiring information about existing conditions were unexcelled.

"In February, 1917, he was appointed chairman of the Committee on Synthetic Drugs of the National Research Council which Committee was the scientific adviser of the Government, and which had been organized the foregoing year under the authority of the National Academy of Sciences. He also held a semi-official position as adviser to the Federal Trade Commission.

"In 1918, he became president of the Chicago Institute of Medicine, an organization having for its object the promotion of medicine through scientific research. At the same time he accepted an appointment in the United States Health Service as Special Expert in Arsenicals.

"The Chemical Foundation was incorporated in February, 1918; the following month Francis Garvan became its president and Dr. Stieglitz its Chemical Adviser. In 1920 he was chosen Consultant for Chemical Warfare Service by General Amos A. Fries. During this period he also maintained his position as Director of the Department of Chemistry at the University of Chicago.

"Thus his facilities for acquiring accurate information regarding the chemical situation in America were unexcelled, and his prestige assured him a sympathetic hearing among those in authority whenever his advice was offered.

"For months the lamentably insufficient supply of synthetic drugs had been an acute problem. Such drugs were formerly imported from Germany almost exclusively. Their number had been much greater than necessary. Many of them had been introduced merely for commercial reasons. Through his various medical connections Stieglitz was able to ascertain that most of these could be dispensed with if but a very small number of the most reliable ones were made available. Only four or five were indispensable and for several reasons it seemed desirable to give these substances new, American names. Arsphenamine was the name coined by Stieglitz for the drug called Salvarsan by the Germans. It is the '606' of Ehrlich and is the recognized cure of syphilis, a disease with which ten million Americans were said to be afflicted.

"Barbital (formerly called Veronal) was the most widely used and reliable hypnotic. Procaine (formerly called Novacaine) was the most useful of all local anaesthetics. Lack of it necessitated the so-called 'Bulgarian operations', those made without anaesthesia. Cincophen (Atophan) was the most efficient drug in the treatment of gout and rheumatism. Phenobarbital (luminal) a sedative and hypnotic, was a specific drug for the prevention of the seizures of epilepsy. Physicians and hospitals were literally begging for this drug for two years before it was made in America.

"As a member of the Committee on Synthetic Drugs, it was the duty of Stieglitz to see that the public received supplies of these indispensable drugs as quickly as possible. To this end he either induced or encouraged certain reliable manufacturers to take up their production. He gave them chemical advice and aided them in obtaining the supplies of auxiliary chemicals that were required, as, for example hydrosulfite, needed to make arsphenamine and bromine, needed in the synthesis of procaine.

"As Adviser to the Federal Trade Commission, his trying duty was to decide to which manufacturers licenses were to be issued, for the production of each drug.

"When, in 1918, it became known to the Federal Health Service that some domestic supplies of arsphenamine were causing serious trouble in the treatment of army cases, Stieglitz, as Special Expert in arsenicals, rendered much valuable service.

"Speaking of the Public Health Service, Dr. George W. McCoy, Chief of the Hygienic Laboratory, says, 'We were urgently in need of the very best advice available anywhere with regard to the standardization as to quality and safety of the preparation of the arsphenamine group. Professor Stieglitz gave unstintedly of his time and effort. It was always a source of great comfort to know that we were proceeding in accordance with the advice and suggestions of Professor Stieglitz.'

"In his capacity as Professor of Chemistry of the University, Stieglitz and his students conducted important researches on arsphenamine in the course of which it appeared to his satisfaction that the specifications given in the patent were not sufficient to guide a trained chemist to the preparation of a safe product. The additional steps which he employed were highly necessary. His investigations on phenobarbital, so long in demand by physicians, led to work by Stieglitz and Mary M. Rising that resulted in the finding of improved methods for its preparation through substitution of methyl esters, which are solids easily purified by recrystallization, for the liquid ethyl esters used originally.

"It was Stieglitz more than any other chemist who stressed the close genetic relationship between the three great classes of organic substances, dyes, war chemicals and medicinals. To these, of course, may be added photographic chemicals. In all his efforts to keep this connection to the forefront he clearly saw that an ultimate solution could only be reached through the establishment in this country of a great dye industry. The dye 'intermediates' are just those chemicals which form the starting material for explosives, war gases, synthetic drugs and photographic chemicals. For economic reasons all must go together. The works and equipment for the manufacture of one class of products serves with little modification for all. It was through his connection with the Chemical Foundation that his greatest efforts on this subject were made. In the record of the trial of this organization, Stieglitz' achievements are recorded in much detail.

"It will be remembered that this was the celebrated case in which the Government tried to set aside as illegal the purchase of over four thousand German patents covering dyes and related substances and their subsequent license to American firms. The Chemical Foundation had acquired title to the patents through their purchase for $250,000 from the Alien Property Custodian.

"The trial occurred in Wilmington, Delaware, in December, 1923, before the Honorable Hugh M. Morris, United States District Judge. In the course of the trial Stieglitz gave valuable testimony in support of the contention of the defendant (C. F.) that a completed dye industry is the logical and only practical defense against a recurrence of the perilous situation in which the country was placed at the outbreak of the World War.

"He showed clearly to the satisfaction of the court how and why an adequate supply of dye intermediates would provide those chemicals indispensable not only for the manufacture of the dyes themselves but also of explosives, war gases, medicinals, photographic and other chemicals. The climax of Stieglitz' testimony, at least for the non-technical audience, was reached when by permission of the court he illustrated his point by an actual demonstration in which he showed that a given intermediate might serve for the preparation of a dye, a medicinal, or a war gas. He placed a few drops of aniline in each of three test-tubes: in the first he produced the dye, mauve, by oxidation of the crude aniline with a drop or two of ferric chloride. In the second tube he converted the aniline into a medicinal, the popular sedative, acetanilide by the use of acetyl chloride. To the aniline in the third tube he added alcoholic potash and a drop of chloroform. The nauseating phenyl isocyanide formed was convincing as a war gas.

"Referring to Stieglitz' testimony in this suit, Dr. Charles L. Parsons writes: 'I remember how complacently he confounded the opposition who thought they were going to make a point by asking him as to the fees he drew from the Chemical Foundation by quietly stating that he never went into court except in the public interest and consequently never accepted any fee therefor. The statement was very effective in the outcome of the trial, which was won by the Chemical Foundation.'

"Dr. Stieglitz was editor and contributor to the well known book, 'Chemistry and Medicine,' a most interesting and informing document. This contribution of forty-three well known scientists was sponsored by the Chemical Foundation and widely distributed, gratis, by Mr. Garvan as a memorial to his daughter, Patricia, who died in childhood.

"His services as Adviser to the Chemical Foundation are thus described in a letter by Mr. William Buffum, treasurer and general manager of the organization, 'His counsel was often sought and freely given. He was always very cooperative in assisting us to solve our general and special problems. It can undoubtedly be said that Dr. Stieglitz was the foremost exponent of American Chemotherapeutic research. He was one of Mr. Garvan's and my closest friends.' As concrete evidence

of his friendship and admiration, Mr. Garvan created the Stieglitz Foundation which was put at the disposal of Dr. Stieglitz for research on problems in the field of chemistry as applied to medicine.

"In accordance with university regulations Stieglitz' retirement took place in September, 1933, at the age of sixty-five. This change in official status did not prevent his retention of his rooms at Jones Chemical Laboratory, the splendid new home of the department given by George Herbert Jones, where as emeritus, he continued to give advice on departmental matters whenever requested to do so. His students were so loath to give him up that they raised a special fund which permitted him to continue his lectures and direct research.

"Although he had numerous attractive opportunities he had steadfastly refused to act as a consulting chemist for industry during his professorship. It was only after his retirement that he made his first and only connection of this kind, a 'half-time' position on the staff of the Universal Oil Products Company. Here he was associated with the able organic chemists, Egloff, Ipatieff, and others. . . .

"He was a trustee for International Critical Tables as representative of the American Chemical Society and contributed materially to its ultimate successful publication. . . .

"A few years prior to her marriage, Dr. Rising had adopted a baby daughter, Kate. It is not strange that after the marriage, little Kate was soon so firmly established in the affection of Dr. Stieglitz that he adopted her. Professor Stieglitz often spoke feelingly of his fondness for children. A typical remark was, 'Babies, I love them. If I could, I would like to have them in the house all the time!' With his three grandchildren, two sons of Mrs. Kuhn and the daughter of Edward, his desires seem to have been realized. The home thus newly established provided for him those things which for him were so necessary for life and productive work.

"In spite of a most strenuous and time-consuming schedule, Stieglitz found some time for diversions. In his younger days, tennis and billiards were his favorites. Later their place was substituted by golf. Stieglitz never played bridge; once when the subject was brought up, Stieglitz remarked, 'I hate cards, that is, except poker: That's not cards but a play of human nature.'

"A hobby in which he attained results of high artistic merit was photography. This was the field in which his older brother, Alfred, had reached world-wide distinction. Much time was spent at this diversion and many splendid prints attest his skill.

"Up to the time of his last illness, Stieglitz had enjoyed consistent good health.

"To the countless thousands who knew him only by his published works Julius Stieglitz was a chemist of high attainments. To the smaller favored number whose acquaintance was more intimate, his friends, colleagues and students, he was a unique and highly gifted personality.

"His life work formed an exceptionally consistent whole in full accord with his oft-expressed formula of a complete academic career. His activities were apportioned with rare idealism between teaching, research, university administration, and public service. To have made a success in one or two of these lines of endeavor would have assured him a lasting remembrance. His preeminence in all four is a symbol of his versatility and stamps him as one of the outstanding men of his time.

"Although Dr. Stieglitz' solicitous care for the welfare of his family was at all times uppermost in his mind, his personal interests were always subordinated in favor of the attainment of his ideal. As an example of this it is related on excellent authority that he once refused a position as chemist in a major industry at $50,000 a year.

"It was a rare trait of Stieglitz' character that in the accomplishment of a desired end he did not merely lend his support to the movement. It was his custom to work out in complete detail a plan by which the project could be carried out. Thanks to his prodigious and accurate memory he could take a conflicting mass of details, sift them, discard the irrelevant, and weave the sound arguments into a convincing whole. His opponents were wont to give way with the remark, 'What's the use, Stieglitz is too logical.'

"Perhaps it is in his relations with his students that his memory is most highly cherished. His popularity as a teacher is attested by the significant fact that in all the University, the number of students who made their doctorate with him was greater than with any other professor. Among this number, 118, are many men and women who have achieved a national reputation. Among those whose life's work is complete and who were most widely known are Dr. Otto Folin, Professor of Biological Chemistry, Harvard Medical School, and Dr. Edwin E. Slosson, author of 'Creative Chemistry' and founder of Science News Service. Many others hold high places in the field of pure and applied chemistry.

"The problems he set for his research students were always well thought out in advance, never too difficult or impossible. In the laboratory his attitude was dignified and formal, but quiet and kindly, never seemingly hurried, but never wasting time or words, never neglecting students but always keeping before them the highest ideals. A typical remark, 'I think the compound can exist, Mr. X. In a week you should have at

least ten grams of it,' was taken by the student as an order that he exerted himself to the utmost to fulfill, although its accomplishment won only the equally mild, but greatly valued, approval, 'Very good, Mr. X.'

"Excepting during the earliest years at Chicago, Dr. Stieglitz rarely carried out his researches with his own hands. Nevertheless he was always critical of apparatus and technique. Often when he was forced to disapprove, his criticism was couched in so humorous a vein as only to spur the man to greater effort to improvement. A beginner at research had set up an apparatus that differed greatly from that described in the reference given. On seeing it Dr. Stieglitz remarked, 'That is not the apparatus used by . . . , Mr. X.' When the student excused the fault as due to his faulty knowledge of German, Dr. Stieglitz left without a word; a minute later he returned, placed on the desk the volume in question, opened to the page showing a figure of the apparatus, 'The picture is not in German, Mr. X.'

"On another occasion when a student in qualitative analysis explained that he was evaporating a solution of ammonia to concentrate it Stieglitz' only comment was, 'Go right ahead, Mr. X.'

"To his students Dr. Stieglitz always lent his helpful sympathy when other resources failed. He was ever ready to listen to their problems and was most happy when he was able to work out a satisfactory solution for their difficulties. With students, as with others he had a great reputation for fair dealing. In many cases the advice was more personal, extending as his daughter (Dr. Hedwig Stieglitz Kuhn, M. D.) humorously avers, 'To every subject from the proper selection of the bride's silver to the choice of an obstetrician.'

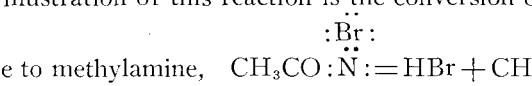
"Always overworked, with his time sorely overcrowded, it is not strange that those who came to his room unannounced to speak on trivial matters often took a brusque dismissal for surliness. This was only apparent and not intended. Until late in life he had no secretary who could protect him from thoughtless intrusions.

"On his part Dr. Stieglitz was always considerate of the time of others. For years the writer's laboratory was directly across the hall from his. He very rarely came informally to discuss matters. Instead it was his custom to place handwritten notes in my box.

"The esteem in which Dr. Stieglitz was held by his contemporaries is amply attested by the many positions of honor and responsibility to which he was called. Little can now be added to his fame by the laudation of his biographer. To employ a favorite maxim of Dr. Stieglitz: 'Let the work show its worth by itself.' The work of Julius Stieglitz is his memorial; a

fitting testimonial to a splendid career. In his work he realized his highest ideal: a life devoted to the advancement of science and the promotion of human welfare."

The first work of importance done by Stieglitz at Chicago was a study of nitrogen halogen compounds published in three papers with Felix Lengfeld. They had hoped that by treating the compound with sodium methylate they could replace the halogen with the methoxy group and obtain a derivative of hydroxylamine. It could not have been understood then that when a halogen atom separates from a nitrogen atom it tends to do so in the positive form, (e.g.: Br, leaving the pair of electrons of the covalence with the nitrogen). For this reason the halogen atom could not be replaced by the negative methoxy group $CH_3:O:$. Instead of this there is a rearrangement which Stieglitz and Lengfeld recognized in their paper as that of Hoffmann and of Hoogewerf and van Dorp by means of which an amide group, $CONH_2$, is replaced by an amino group. The simplest illustration of this reaction is the conversion of bromo-



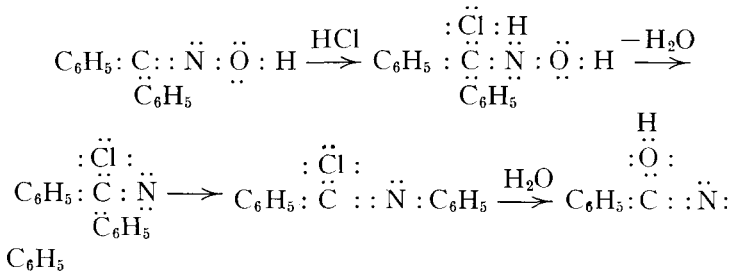
acetamide to methylamine, $CH_3CO:\ddot{N}:=HBr+CH_3CO:\ddot{N}:$.

The methyl group then shifts to the univalent, highly unsaturated, nitrogen atom, and a pair of electrons shifts to give a double covalence between the nitrogen atom and the carbonyl group, forming methyl isocyanate, $CH_3:\ddot{N}::C::\ddot{O}$. Sodium hydroxide then hydrolyses the isocyanate to methylamine, CH_3NH_2, and sodium carbonate.

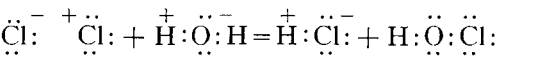
The reaction was not formulated in this way by Lengfeld and Stieglitz but the momentary formation of univalent nitrogen atoms was postulated by Stieglitz and his students in many reactions studied by them in later years. They never expressed these by means of electronic formulas, however.

In 1896 Stieglitz and his students began a study of the "Beckmann Rearrangement." He and his students continued the study of this rearrangement and of similar rearrangements of derivatives of triphenylmethylamine for more than twenty years. The work of this group furnished a major contribution to the solution of this difficult problem. One of their most important

suggestions was that of Stieglitz and Leech, J. Am. Chem. Soc. *36*, (*272*, 607). When hydrochloric acid is the catalyst they assumed that this adds itself to the double union between carbon and the nitrogen of the oxime group, the chlorine uniting with the carbon and the hydrogen with the nitrogen as they are known to do in other similar cases. Water then separates from the nitrogen as it does from ammonium hydroxide. This leaves a univalent nitrogen atom to which one of the radicals combined with the carbon atom of the original ketoxime shifts as it does in many other cases studied by Stieglitz and his students. Hydrolysis of the chlorine atom combined with the carbon atom gives a hydroxyl compound tautomeric with the amide which is the final product of the rearrangement. The reactions for the oxime of benzophenone are as follows:



One of the most important theoretical suggestions made by Professor Stieglitz is found in an article published in 1901. After approving an article published by the author of this sketch in which an ionic reaction of molecular chlorine was assumed, he stated that he had presented similar views before students and professional colleagues in the University of Chicago. He cited the work of Jakowkin in which the latter demonstrated that chlorine water contains a mixture of molecular chlorine, hypochlorous acid and hydrochloric acid in equilibrium with each other. Professor Stieglitz explained this equilibrium as the result of a reversible reaction:



He emphasized in this paper the minimal formation of the positive chlorine ions, a fact not demonstrated till many years later.

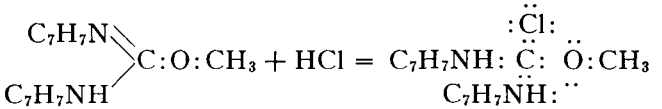
The paper implies that other covalent compounds may ionize

in a similar manner but this was not reconciled with the electronic theory of G. N. Lewis till 1923. (J. Am. Chem. Soc. *45*, 2950.)

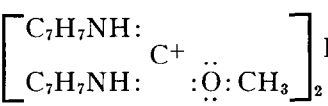
In 1903 Stieglitz published a paper on the theories of indicators. He showed that Ostwald's theory that a compound which is a weak acid and ionizes only slightly in a neutral or acid solution but ionizes to a large extent in the presence of hydroxyl ions which suppress the hydrogen ions, giving colored ions, is only a partial explanation of the conduct of an indicator. Ostwald failed to understand that the alkaline solutions cause a molecular rearrangement of the indicator giving deeply colored anions or, with some indicators such as methyl orange, give anions having a different color from that of the original indicator. Bernthsen had shown this relation ten years earlier but Ostwald had overlooked this.

Stieglitz explained the color as due to a quinoid structure due to a ketone or imido group in different indicators. His paper "Theories of Indicators" is a classic which furnishes a basis for all subsequent accurate discussions of this important topic.

In two papers published by Stieglitz and by Stieglitz and Dains in 1899, they came to the conclusion that the chlorine atom of hydrochloric acid adds to the carbon atom of an imido ester ("ether") while the hydrogen adds to the nitrogen.



The removal of a chloride ion from this compound to form the chloroplatinate ion, $PtCl_6$, would leave the carbon positive because it would have only three covalences, just as nitrogen with four covalences and no unshared electrons is positive. Dains prepared a chloroplatinate of this carbonium ion. This must have the structure,



At the time when these papers were written, electronic formulas for these compounds could not have been written.

Many chemists still fail to recognize that the six chlorine atoms of a chloroplatinate are united to the platinum atom with covalences and not in part to the univalent positive ion.

In 1904 Professor Stieglitz was asked to give one of the principal addresses at the International Congress of Arts and Sciences at St. Louis. His subject was "The Relation of Organic Chemistry to other Sciences." In this address he began his discussion of catalysis which was one of his major subjects of research for more than ten years.

During the nineteenth century a catalyst was supposed to be a substance which caused the acceleration of a reaction by its presence without combining with the reacting substances and without affecting the equilibrium involved in the reaction. Professor Stieglitz directed his attention primarily to the feature of acceleration and studied especially imido esters. The combination of the catalyst with the ester is involved and the older definition of catalysis was abandoned.

When Stieglitz took his degree in 1889 German chemists were mostly studying the structure of organic compounds, and physical chemistry was not thought to be an essential study in the training of a chemist. When Professor Stieglitz began the study of the catalysis of the hydrolysis of the imido esters he found that in order to understand clearly the mechanism of the reaction it would be necessary to use the methods of physical chemistry and the calculus, with which he was not familiar. He took the time and pains required to master so much of these subjects as was necessary for his purpose.

This study of catalysis furnished the basis for his study of esterification and saponification and went far to clarify the minds of chemists on these subjects.

Almost from the beginning of his instruction at the University, Dr. Stieglitz had charge of courses in analytical chemistry. His lectures were very carefully prepared and followed the general lines suggested by Ostwald's "Wissenschaftliche Grundlagen der analytischen Chemie."

After teaching the subject for many years he published in two volumes his "Qualitative Chemical Analysis" with the subtitle, "With special consideration of the laws of equilibrium and of the modern theories of solution." The book is a classic

and has been used in many of our best colleges and universities and is still so used.

The publishers state that there have been twenty printings. It has been almost the only text on the subject in China and it has been extensively used in Burma and India.

In 1915 Stieglitz published a paper on molecular rearrangements in which he followed J. J. Thomson's original electronic theory in which Thomson assumed that atoms are held together by the static attractions caused by the transfer of single electrons from one atom to another. This led Stieglitz to the use of such formulae as $R_2N - + Cl$, which are quite unsatisfactory now. It is surprising how closely he approached more modern views, and how helpful the Thomson theory proved to be as Stieglitz used it. His paper could be translated into modern electronic formulae by the use of the following principles recognized since his paper was written.

1. Positive charges of atoms and molecules reside exclusively in the nuclei of the atoms and negative charges in the electrons.
2. Atoms held together by a covalence may separate in two ways:
   a. One electron may remain with each atom. The atoms remain electrically neutral.
   b. The covalence pair may go with one of the atoms. This atom will be negative and the other positive.
3. A halogen atom held to nitrogen by a covalence usually separates in the positive form because the kernel of the nitrogen having only two electrons holds the covalence pair strongly. A halogen atom held to a phosphorus atom usually leaves it in the negative form carrying the covalence pair with it because the phosphorus kernel has ten electrons.*

One of the most important parts of Stieglitz' theory is the formation of a momentary univalent nitrogen atom as an intermediate in the process. This has already been mentioned in discussing his work on the Beckmann rearrangement and illus-

* See Chem. Reviews *17*, 19 (1935); J. Am. Chem. Soc. *51*, 2392 (1929); Modern Alchemy p. 107.

trates how closely Stieglitz' researches were knit together and the care with which he worked out his ideas.

During the last years of the nineteenth century Hantsch explained the stereoisomerism of oximes by assuming a double union between the carbon and nitrogen atoms similar to the double union between two carbon atoms which causes the stereoisomerism of fumaric and maleic acids. In order to obtain independent support for this view Stieglitz and his students prepared several compounds of the type:

$$\begin{array}{l} R-C-O-R' \\ \quad\ \| \\ Cl-N \end{array} \quad \text{and} \quad \begin{array}{l} R-C-O-R' \\ \quad\ \| \\ \quad\ N-Cl \end{array}$$

The stereoisomerism of these compounds was demonstrated by very careful and conclusive experiments.

It may be worth while to remark that the syn and anti groups which give the stereoisomerism in these cases are the chlorine atom and a pair of unshared electrons, while in the oximes the groups are the hydroxyl group and a pair of unshared electrons. Both hydroxyl and chlorine tend to separate from nitrogen in the positive, ephemeral and unstable form and, as Stieglitz has shown, chlorine atoms of this character do not readily rearrange unless the nitrogen also bears a hydrogen atom. It seems quite certain that the stereoisomerism is dependent on this fact.

In 1920 Professor Stieglitz gave an address before the Minnesota Section of the American Chemical Society on the "Theory of Color Production." The address as given at the Minnesota Section was not published but it was published in an abbreviated form in the Proceedings of the National Academy of Sciences in 1923 and in a more complete form in the Journal of the Franklin Institute in 1925.

In this address Stieglitz pointed out that the connection between the color of an organic compound and certain groups known as "chromophore" and "auxochrome" groups had long been known but that no attempt had been made to account for the action of these groups. He started by pointing out that color phenomena must be due to very short and, therefore, very rapid light waves. He concludes that these rapid waves must be due to electrons and not to atoms or molecules. He then

recalled that all dyes may be reduced to colorless, "leuco" compounds, a process which requires the addition of electrons, and that the leuco compound may, in turn, be oxidized, regenerating the dye by the removal of electrons. He considered that the ability of dyes to absorb light is due to the vibration of these mobile but restrained electrons. Apparently no one has given a better theory of the cause of the color of dyes.

Professor Stieglitz first took up the electron theory of valence on the basis of the theory of J. J. Thomson that atoms are held together by the transfer of single electrons from one atom to another, causing a static attraction between them. This would give a polar character to all chemical unions. In 1922 he published a paper on "The Electron Theory of Valence as Applied to Organic Compounds." In this paper he discusses carefully and at some length the advantages in favor of the view that organic compounds are held together by the static attraction between atoms one of which is electrically positive and the other electrically negative. The paper is still very valuable because in it Stieglitz cites numerous cases where the reactions of organic compounds indicate very clearly that many such compounds separate in such a manner as to show that one part of each is negative and the other positive. The following year the writer of this sketch published a short paper which reconciled these reactions with the theory of G. N. Lewis, J. Am. Chem. Soc. *45*, 2959 (1923).

One hundred and eighteen dissertations for the degree of Ph.D. based on experimental work done under the direction of Professor Stieglitz were submitted to the University of Chicago from 1896 to 1936. In accordance with the custom of the University, abstracts of the experimental work were usually published in the chemical literature under the name of the student. Comparatively few of these papers can be found in the indexes listed under the name of Stieglitz.

More than eighty of these dissertations do not appear in any form in standard chemical literature. The theses were, however, filed in the Chemistry Library of the University of Chicago and are available for examination by individuals who are interested. The titles of these theses are listed in the bibliography appended to this biography.

KEY TO ABBREVIATIONS

Am. Chem. J.—American Chemical Journal. Merged into Journal of the American Chemical Society, 1914
Ber.—Berichte der Deutsche Chemische Gesellschaft
Boston M. & S. J.—Boston Medical and Surgical Journal
Carnegie Inst. Pub.—Carnegie Institution of Washington Publications
Chem. Bull. Chicago—Chemical Bulletin, Chicago
Chem. Met. Eng.—Chemical and Metallurgical Engineering
Eighth Inter. Cong. App. Chem.—Eighth International Congress of Applied Chemistry
I. C. F. N.—International Catholic Federation of Nurses
Ind. Eng. Chem.—Industrial and Engineering Chemistry
J. Am. Chem. Soc.—Journal, American Chemical Society
J. A. M. A.—Journal, American Medical Association
J. Franklin Inst.—Journal, Franklin Institute
J. Ind. Eng. Chem.—Journal, Industrial and Engineering Chemistry
J. Pharmacol.—Journal of Pharmacology
N. Y. Med. J.—New York Medical Journal
Proc. Chem. Soc.—Proceedings, Chemical Society
Proc. Inst. Med. Chicago—Proceedings, Institute of Medicine, Chicago
Proc. Nat. Acad. Sci.—Proceedings, National Academy of Sciences
Sci. Mo.—Scientific Monthly
Trans. Am. Inst. Chem. Eng.—Transactions, American Institute of Chemical Engineers
Trans. Ill. State Acad. Sci.—Transactions, Illinois State Academy of Science
Univ. Chicago Mag.—University of Chicago Magazine

BIBLIOGRAPHY OF JULIUS STIEGLITZ

Including Ph.D. dissertations prepared by students working under his supervision.

1889

Ueber die Kondensation der Säueramide und analoger Körper durch Abspaltung von Ammoniak oder dessen Derivaten. Inaugural Dissertation Universität zu Berlin, Dec. 14, 1889.

Ueber das Verhalten der Amidoxime gegen Diazobenzolverbindungen. Ber. *22*, 3148-60.

1891

On Benzoquinonecarboxylic Acids. Am. Chem. J. *13*, 38-42.

1893-4

Derivatives of Nitrogen Halogen Compounds. (With Felix Lengfeld.) Am. Chem. J. *15*, 215-22 (1893); II *ibid.* *15*, 504-18 (1893); III *ibid.* *16*, 370-72 (1894).

1894

Ueber Alkylisoharnstoffe (Imidocarbaminsäureäther). (With Felix Lengfeld.) Ber. *27*, 926-7.

The Action of Phosphorus Pentachloride on Urethanes. (With Felix Lengfeld.) Am. Chem. J. *16*, 70-78.

1895

Note to article by E. E. Slosson, Ueber die Einwirkung von unterbromiger und unterchloriger Säure auf Säureanilide. Ber. *28*, 3269-70.

On Imido-Ethers of Carbonic Acid. (With Felix Lengfeld.) Am. Chem. J. *17*, 98-113.

Ueber die Einwirkung von Natriumäthylat auf Carbodiphenylimid. Ber. *28*, 573-4.

Ueber Thiamine. (With Felix Lengfeld.) Ber. *28*, 575-76.

Ueber Thiamine. (With Felix Lengfeld.) Ber. *28*, 2742-44.

1896

On the "Beckmann Rearrangement". I. Chlorimidoesters. Am. Chem. J. *18*, 751-61.

1897

Ph. D. Dissertation of Otto Folin. On Urethanes. Am. Chem. J. *19*, 323-52.

1899

On the Constitution of the Salts of Imido Ethers and other Carbamide Derivatives. Am. Chem. J. *21*, 101-11.

Ph. D. Dissertation of Frank Burnett Dains. On Isourea Ethers and other Derivatives of Ureas. J. Am. Chem. Soc. *21*, 136-92.

Ph. D. Dissertation of Herbert Newby McCoy. On the Hydrochlorides of Carbophenylimido Derivatives. Am. Chem. J. *21*, 111-67. Preliminary reports, Ber. *30*, 1090-94 (1897); Ber. *30*, 1682-93 (1897).

Ph. D. Dissertation of Elizabeth Jeffreys. On Undecylamine and Pentadecylamine and the preparation of Higher Amines of the Alliphatic Series. Am. Chem. J. *22*, 14-44. Preliminary report, Ber. *30*, 898-901 (1897).

1900

Notes on Lecture Experiments to Illustrate Equilibrium and Dissociation. Am. Chem. J. *23*, 404-8.

Note on Nitrogen Halogen Compounds. (With E. E. Slosson.) Proc. Chem. Soc. *16*, 1-2.

Ph. D. Dissertation of James Harvey Ransom. On the Molecular Rearrangement of o-Aminophenylethylcarbonate to o-Oxyphenylurethane. Am. Chem. J. *23*, 1-50. Preliminary report, Ber. *31*, 1055-66 (1898).

1901

On Positive and Negative Halogen Ions. J. Am. Chem. Soc. *23*, 797-99.
Ph. D. Dissertation of Ralph Harper McKee. On the Oxygen Ethers of Ureas; Methyl and Ethylisoureas. Am. Chem. J. *26*, 209-64. Preliminary papers, Ber. *32*, 1494-96 (1899); *33*, 807-12 (1899); *33*, 1517-19 (1900).

1902

Book Review: The Elements of Physical Chemistry. By Harry C. Jones. Macmillan Co. N. Y., 1902. J. Am. Chem. Soc. *24*, 588-91.

1903

The Theories of Indicators. J. Am. Chem. Soc. *25*, 1112-27.
On the "Beckmann Rearrangement" II. Am. Chem. J. *29*, 49-68.
The "Beckmann Rearrangement" III. Stereoisomeric Chlorimido Acid Ethers. (With Richard B. Earle.) Am. Chem. J. *30*, 399-412.
The "Beckmann Rearrangement" IV. Am. Chem. J. *30*, 412-21.
Ph. D. Dissertation of Edwin Emery Slosson. On Acylhalogenamine Derivatives and the Beckmann Rearrangements. Am. Chem. J. *29*, 289-319. Preliminary papers, Ber. *28*, 3265-69 (1895); Ber. *34*, 1613-16 (1901).

1904

Ph. D. Dissertation of Henry Taber Upson. The Molecular Rearrangement of Aminophenylalkyl Carbonates, III. Am. Chem. J. *32*, 13-43. I and II, Am. Chem. J. *31*, 458-502.
On the Beckmann Rearrangement. Decennial Publications of the University of Chicago, First Series, *9*, 75-87.
The Relation of Organic Chemistry to Other Sciences. Proc. International Congress of Arts and Sciences, St. Louis, 1904, Vol. IV, 276-84. Houghton, Mifflin and Co. (1906).
The Constitution of Purpuric Acid and of Murexide. (With Max Slimmer.) Am. Chem. J. *31*, 661-679.
Book Review: Quantitative Analysis for Mining Engineers. By Edmund H. Miller. Van Nostrand Co., N. Y. 1904. J. Am. Chem. Soc. *26*, 718-19.
Ph. D. Dissertation of William McAfee Bruce. On the Oxygen Ethers of Urea. J. Am. Chem. Soc. *26*, 419-36; 449-64.

1905

Book Review: Kritische Studien über die Vorgänge der Autoxydation. By C. Engler and J. Weissberg. Vieweg und Sohn, Braunschweig, 1904. J. Am. Chem. Soc. *27*, 79-80.
On Chloronium Salts. (With Edith E. Barnard.) J. Am. Chem. Soc. *27*, 1016-19.
Ueber die Isoharnstoffe. (With R. P. Noble.) Ber. *38*, 2243-44.

1907

Note on the article entitled, "Studies in Catalysis" by S. F. Acree. Am. Chem. J. *38,* 743-46.

Chemical Research in American Universities. Inaugural Address, University of Illinois, Oct. 18, 1907. Science. *New Series 26,* 699-703.

Book Review: The Principles of Qualitative Analysis from the Standpoint of the Theory of Electrolytic Dissociation and the Law of Mass Action. By Wilhelm Böttger. P. Blakiston's Son and Company, Philadelphia, 1906. J. Am. Chem. Soc. *29,* 1129-30.

Ph. D. Dissertation of Louis Agassiz Test. Rearrangement of o-Aminophenyl Esters. No copy available.

Ph. D. Dissertation of Robert Anderson Hall. Action of Ammonia on Isourea Esters. No copy available.

Ph. D. Dissertation of Katherine Blunt. The Formation of Amidines. No copy available.

Ph. D. Dissertation of Edith Ethel Barnard. Catalysis of Imido Esters as affected by the presence of non-electrolytes and Electrolytes. No copy available.

1908

Studies in Catalysis, I: The Catalysis of Esters and of Amidoesters by Acids. Am. Chem. J. *39,* 29-63.

Studies in Catalysis, II: The Catalysis of Imidoesters. Am. Chem. J. *39,* 166-83.

Studies in Catalysis, III: The Theories of Esterification and Saponification. Am. Chem. J. *39,* 402-31.

The Theory of Indicators. Am. Chem. J. *39,* 651-53.

Note on the Solubility Product. J. Am. Chem. Soc. *30,* 946-54.

The "Syn" and "Anti" Stereoisomerism of Nitrogen Compounds. Am. Chem. J. *40,* 36-46.

The Application of Physical Chemistry to Organic Chemistry. (Address before the American Chemical Society, December, 1907.) Science. *New Series 27,* 768-75.

Book Review: The Chemistry of Diazo-Compounds. By John Connell Cain. Edward Arnold. London, 1908. J. Am. Chem. Soc. *30,* 1797-8.

Book Review: Die Chemische Affinität und ihre Messung. By Otto Sackur. Vieweg und Sohn, 1908. J. Am. Chem. Soc. *30,* 1795.

Book Review: Laboratory Manual of Qualitative Analysis. By Wilhelm Segerblom. Longmans, Green and Co. 1908. J. Am. Chem. Soc. 1795-6.

Book Review: Outlines of Qualitative Chemical Analysis. By Frank Austin Gooch. John Wiley & Sons, New York, 1906. J. Am. Chem. Soc. *30,* 1796.

Book Review: Qualitative Analysis von Standpunkte der Ionenlehre. By Wilhelm Böttger. Wilhelm Engelmann, Leipzig, 1908. J. Am. Chem. Soc. *30,* 1796-7.

Book Review: Kurzes Lehrbuch der Organische Chemie. By William A. Noyes. Akademisches Verlagsgesellschaft, Leipzig, 1907. J. Am. Chem. Soc. *30*, 906-8.

Book Review: A Textbook of Organic Chemistry. By A. F. Holleman. John Wiley & Sons, New York, 1907. J. Am. Chem. Soc. *30*, 158-9.

Book Review: Organic Chemistry including Certain Portions of Physical Chemistry, for Medical, Pharmaceutical and Biological Students. By H. D. Haskins and J. J. R. MacLeod. John Wiley and Sons, New York, 1907. J. Am. Chem. Soc. *30*, 156-8.

Ph. D. Dissertation of Ira H. Derby. Studies in Catalysis IV. The Catalysis of Imidoesters. Am. Chem. J. *39*, 437-73. Preliminary paper, A Study of Hydrolysis by Conductivity Methods. Am. Chem. J. *31*, 449-58 (1904).

Ph. D. Dissertation of William McCracken. Studies in Catalysis V. The Catalysis of Imidoesters. Am. Chem. J. *39*, 586-613.

Ph. D. Dissertation of Hermann I. Schlesinger. Studies in Catalysis VI. The Catalysis of Imidoesters. Am. Chem. J. *39*, 719-71.

Ph. D. Dissertation of Willis Stose Hilpert. Stereoisomeric Chlorimido Acid Esters. Am. Chem. J. *40*, 150-94.

1909

The Relation of equilibrium between the Carbon Dioxide of the Atmosphere and the Calcium Sulfate, Calcium Carbonate and Calcium Bicarbonate of Water Solutions in Contact with it. Carnegie Inst. Pub. *107*, 235-64.

Ph. D. Dissertation of Peter Powell Peterson. Stereoisomeric Chlorimido Ketones. Am. Chem. J. *46*, 325-44. Preliminary paper, Ueber Stereoisomere Chlorimido-Ketone. Ber. *43*, 782-87 (1910).

Ph. D. Dissertation of Lemuel Charles Raiford. On Chlorimidoquinones. Am. Chem. J. *46*, 417-56.

Ph. D. Dissertation of William Weldon Hickman. The Catalysis of Imidoesters in the Presence of Acids. (Typewritten.) Abstract in Univ. Chicago, Science Series, *1*, 189-95 (1922-23).

1910

Catalysis on the Basis of Work with Imidoesters. J. Am. Chem. Soc. *22*, 221-31.

The Relation of Pure and Applied Science to the Progress of Knowledge and of Practical Affairs. 2. The Relation of Pure and Applied Chemistry. Trans. Ill. State Acad. Sci. *3*, 62-7.

Ph. D. Dissertation of John Colin Moore. The Action of Water on Acylisoureas, etc. (Typewritten.)

Ph. D. Dissertation of Emma Perry Carr. The Aliphatic Imido Esters. (Typewritten.) Abstract in Univ. Chicago, Science Series, *1*, 137-46 (1922-23).

1911

The Elements of Qualitative Analysis with Special Consideration of the Application of the Laws of Equilibrium and of the Modern Theories of Solution. 2 vols. Century Co., N. Y.

Ph. D. Dissertation of Le Roy Samuel Weatherby. The "Salt Effect" of Nitrates and Sulfonates in the Catalysis of Imido Esters. (Typewritten.) Abstract in Univ. Chicago, Science Series *2*, 179-87 (1923-4).

Ph. D. Dissertation of John Foote Norton. Simultaneous Reactions in Amidine Formation. (Typewritten.) Abstract in Univ. Chicago, Science Series, *5*, 223-7 (1926-7).

Ph. D. Dissertation of Harlan Leo Trumbull. The Molecular Rearrangement of Acid Chloramides and the ionization of their Salts. (Typewritten.)

1912

Catalysis on the Basis of Work with Imido Esters: The "Salt Effect." J. Am. Chem. Soc. *34*, 1687-95.

1913

Catalysis on the Basis of Work with Imido Esters: A Contribution to the Problem of Saponification and Esterification. J. Am. Chem. Soc. *35*, 1774-9.

Chairman's Address at the Willard Gibbs Medal Award to Dr. L. H. Baekeland, May 16, 1913. J. Ind. Eng. Chem. *5*, 504-5.

Ph. D. Dissertation of George Oliver Curme, Jr. The Thermal Decomposition of Symmetrical Diarylhydrazines—A Reaction of the First Order. J. Am. Chem. Soc. *35*, 1143-73. Preliminary paper, Ber. *46*, 911-20 (1913).

Ph. D. Dissertation of Ethel Mary Terry (Mrs. McCoy). The Coefficient of Saponification of Ethyl Acetate by Sodium Hydroxide. J. Am. Chem. Soc. *49*, 2216-22 (1927).

Ph. D. Dissertation of Paul Nicholas Leech, Jr. I. The Molecular Rearrangement of Triarylmethylhydroxylamines and the "Beckmann" Rearrangement of Ketoximes. J. Am. Chem. Soc. *36*, 272-301, 607 (1914). II. A color Reaction of Hypochlorites with Methylaniline and Ethylaniline. J. Am. Chem. Soc. *35*, 1042-44. Preliminary papers Eighth Inter. Cong. App. Chem. *25*, 443 (1912); Ber. *46*, 2147-51.

1914

Book Review: L'Addivité des Propriétés Diamagnetiques et son utilatisation dans la Recherche des Constitutions. By Paul Pascal. A. Hermann et Fils, Paris, 1913. J. Am. Chem. Soc. *36*, 456.

Ph. D. Dissertation of Bert Allen Stagner. Molecular Rearrangements of β-triphenylmethyl—β-methylhydroxylamines and the Theory of Molecular Rearrangements. The Molecular Rearrangement of Triarylmethylhydroxylamines. Private edition distributed by Univ. Chicago Libraries, 1916. I. J. Am. Chem. Soc. *38*, 2046-68 (1916); II. J. Am. Chem. Soc. *38*, 2069-81 (1916).

Ph. D. Dissertation of Agnes Fay Morgan. I. The Molecular Rearrangements of Some Triarylmethylchloroamines. II. The Viscosities of Various Methyl- and Ethylimido-benzoate Salts and of *Para*- and *Meta*-nitrobenzoylchloramides in moderately concentrated Aqueous Solutions. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 213-17 (1922-23). Part I, J. Am. Chem. Soc., *38*, 2095-2101 (1916).

1915

Molecular Rearrangements of Triphenylmethane Derivatives. I. General Discussion. Proc. Nat. Acad. Sci. *1*, 196-202.

Molecular Rearrangements of Triphenylmethane Derivatives. II. Experimental Part. (With Collaborators.) Proc. Nat. Acad. Sci. *1*, 202-10 (1915).

Presentation Address: Willard Gibbs Medal Award to Arthur A. Noyes, April 16, 1915. J. Ind. Eng. Chem. *7*, 449-50.

John Ulric Nef. Univ. Chicago Mag. *8*, 17-18.

1916

Ph. D. Dissertation of Helen Treadway. The Thermal Decomposition of Symmetrical Diarylhydrazines. Private edition distributed by Univ. Chicago Libraries, 1916. J. Am. Chem. Soc. *38*, 1736-60.

Ph. D. Dissertation of Townes Randolph Leigh. I. Chlorimidoesters. II. Chlorimidobenzil. (Typewritten.) Private edition distributed by Univ. Chicago Libraries, 1922.

Life and Work of John Ulric Nef. Trans. Ill. State Acad. Sci., *9*, 18-19.

The Oxidation of Carbohydrates. Proc. Inst. Med. Chicago *1*, 41-50.

Ph. D. Dissertation of Issabelle Marion Vosburgh (1911-13). The Molecular Rearrangement of Triphenylmethylhalogen Amines. Private edition distributed by Univ. Chicago Libraries. J. Am. Chem. Soc. *38*, 2081-95. Abstract, Eighth Inter. Cong. App. Chem. *25*, 445 (1912). Ber. *46*, 2151-56 (1913).

1917

Address at opening session Kansas City Meeting, American Chemical Society. J. Ind. Eng. Chem. *9*, 443-46.

American Chemical Industry and the American Chemical Society. (Third Exposition of Chemical Industries.) J. Ind. Eng. Chem. *9*, 1005-6.

The Outlook in Chemistry in the United States. J. Am. Chem. Soc. *39*, 2095-2110. Science, *46*, 321-333.

War Service of Chemists. (With Charles L. Parsons.) Editorial, J. Ind. Eng. Chem. *9*, 730.

Sigma Xi's Opportunity. Sigma Xi Quarterly, *5*, 49-53.

Why the Nation Needs Chemistry. Independent *92*, 90.

Ph. D. Dissertation of Sidney Marsh Cadwell. I. The Effect of Acid on the Speed of Rearrangement of the Benzene Sulphonyl Ester of Benzophenoneoxime. II. The Quantitative Determination of very Small Amounts of Gold, Especially in Animal Tissues. (Typewritten.) Abstract in Univ. Chicago, Science Series, *1*, 131-36 (1922-23).

Ph. D. Dissertation of Adeline Mae De Sale (Mrs. Link). The Velocity of rearrangement of Benzoyl Azide. (Typewritten.) Abstract in Univ. of Chicago Science Series, *1*, 163-7 (1922-3).

Ph. D. Dissertation of James Kuhn Senior. The Molecular Rearrangement of Triarylmethylazides. The Molecular Rearrangement of Sym.-bis-triarylmethylhydrazines. Private edition distributed by Univ. Chicago Libraries, 1917. J. Am. Chem. Soc. *38*, 2718-26: 2728-36 (1916). Preliminary report, Proc. Nat. Acad. Sci. *1*, 207-10 (1915).

Ph. D. Dissertation of Ralph Lyman Brown. The Molecular Rearrangement of Sym.-bis-triphenylmethylhydrazine. Private edition distributed by Univ. Chicago Libraries, 1922. J. Am. Chem. Soc. *44*, 1270-92 (1922).

1918

The Problem of the Synthetic Drug. Abstract of Talk before 69th Annual Meeting of American Medical Association, Chicago, June 10, 1918, N. Y. Med. J. *107*, 1193.

Synthetic Drugs, I. J. A. M. A. *70*, 536-7; II. *ibid.* 688-9; III. *ibid.* 923.

Procaine and Novocaine Identical (A letter to the Editor). Boston M. and S. J. *178*, 916.

Synthetic Pharmaceuticals and the Patent Law. Trans. Am. Inst. Chem. Eng. *11*, 369-82.

The Preparation of Phenylethylbarbituric Acid. (With Mary Rising). J. Am. Chem. Soc. *40*, 723-30.

New Chemical Warfare. Yale Review, *7*, 493-511.

Henry Shaler Williams and the Society of Sigma Xi. Sigma Xi Quarterly, *6*, 68-69.

Letter to the Chairmen and Secretaries of the Sections of the American Chemical Society, on "The Reduction of Waste." Dec. *22*, 1917. J. Ind. Eng. Chem. *10*, 153.

Letter to Mr. H. LeB. Gray on "The Reduction of Waste", Dec. *27*, 1917. J. Ind. Eng. Chem. *10*, 153.

Ph. D. Dissertation of Harry Clyde Trimble. The Effect of Electric Currents in the Attempt to Induce Molecular Rearrangements. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 257-62 (1922-3).

Ph. D. Dissertation of Denton Jacobs Brown. The Velocity of Decomposition of Benzoyl Peroxide. An Electroanalytical Method for the Determination and Separation of the Metals of the Copper-Tin Group. (Typewritten.) Abstract in Univ. Chicago Science Series, *3*, 101-4 (1924-5).

Ph. D. Dissertation of Ralph Emory Nelson. The Velocity of Saponification of Ethyl Acetate by Sodium Hydroxide under Conditions of Varying Concentrations of Ester and Base at 25° and 18°. (Typewritten.)

1919

Samuel Wendell Williston. In the Society of Sigma Xi. Sigma Xi Quarterly, *7*, 22-25.

Report of the Committee on War Service for Chemists. J. Ind. Eng. Chem., *11,* 413-15.

Report of the Committee on Publication of Compendia of Chemical Literature, etc. J. Ind. Eng. Chem., *11,* 415-17.

Report of the Committee on Cooperation between the Universities and the Industries. J. Ind. Eng. Chem., *11,* 417.

Chemistry and Medicine; a Tribute to the Memory of John Harper Long. Science, *49,* 31-38. Proc. Inst. Med., Chicago, *2,* 124-33 (1918-19).

Back to the Colleges and Universities. (Letter to the Editor.) J. Ind. Eng. Chem., *11,* 378.

Introduction to book: Creative Chemistry, by Edwin E. Slosson. Garden City Publishing Company, New York.

Ph. D. Dissertation of Henry John Rossbacher. *m*-Tolylethyl-barbituric Acid. (Typewritten.)

1920

A Comment from Dr. Julius Stieglitz. Chem. Bull., Chicago, *1,* 103-4.

William Albert Noyes. In Appreciation. J. Ind. Eng. Chem. *12,* 106.

President's Address. Twentieth Convention of Sigma Xi, Dec. 30, 1919. Sigma Xi Quarterly, *8,* 3-9.

Ph. D. Dissertation of Mary M. Rising (Mrs. Julius Stieglitz). I. The Preparation of Phenylethylbarbituric Acid. II. The preparation of *p*-Ureido-phenylacetylurea and related Compounds. III. An Attempt to filter the Enzymes of Milk. Private edition distributed by Univ. Chicago Libraries, 1920. I. J. Am. Chem. Soc., *40,* 723-30 (1918). II. J. Am. Chem. Soc. *42,* 128-36. III. (With Jean Piccard) J. Am. Chem. Soc. *40,* 1275-81 (1918).

Ph. D. Dissertation of Herman Vance Tartar. The Constitution of Murexide and the Theory of Dyes. (Typewritten.)

Ph. D. Dissertation of John Edward Schott. I. Oxidation and Rearrangement of Benzamide. II. Derivatives of Phenylethylbarbituric Acid. (Typewritten.)

Ph. D. Dissertation of Frank Louis Debeukelaer. Urea Derivatives of Phenylethylacetic Acid. (Typewritten.) Abstract in Univ. of Chicago Science Series, *1,* 155-61 (1922-3).

Ph. D. Dissertation of Steward Basterfield. Derivatives of Ethylisourea Ether and their Pharmacological Properties. (Typewritten.) Printed in part in J. Pharmacol., *20,* 451-61 (1923).

1921

Presentation of the Willard Gibbs Medal to Madame Curie. Chem. Met. Eng. *24,* 1137.

The Theory of Color Formation. Address given at the 90th meeting of the Minnesota Section of the American Chemical Society, Dec. 3, 1920. J. Am. Chem. Soc. *43,* Proc. 36.

Preparation of 5,5′-Mercuri-bis-3-nitro-4-hydroxy-phenyl-arsonic Acid (With Morris Kharasch and Martin Hanke). J. Am. Chem. Soc. *43,* 1185-93.

Ph. D. Dissertation of Martin Edward Hanke. An Attempt to Prepare a Mercury Derivative of Dioxydiaminoarsenobenzene (Arsphenamine) (Typewritten).

Ph. D. Dissertation of George Ross Robertson. Arsenical Derivatives of Phenylacetic Acid. (Typewritten). J. Am. Chem. Soc., *43*, 179-81; 182-5.

Ph. D. Dissertation of James Hollingsworth Clemmer Smith. (Typewritten.) I. Arsenic Derivatives of Phenylaminoacetic Acid. II. The Estimation of Sodium Hyposulfite. Abstract in Univ. Chicago Science Series, *1*, 231-4 (1922-3); II. J. Am. Chem. Soc. *43*, 1307-8.

1922

The Electron Theory of Valence as Applied to Organic Compounds. J. Am. Chem. Soc. *44*, 1293-1313.

Addendum to above, J. Am. Chem. Soc. *44*, 1833-4.

Ph. D. Dissertation of Lyman Chalkley, Jr. I. The Mercurization of Methylene Blue. II. The Mercurization of some substituted Phenyl Ammonium Salts and Anilines. III. Nitrobenzene Mercury Compounds, an indirect Method of Mercurizing Organic Compounds. Abstract in Univ. Chicago Science Series *1*, 147-53 (1922-3). I. J. Am. Chem. Soc. *47*, 2055-61 (1925).

Ph. D. Dissertation of Quaesita Cromwell Drake. An Investigation of the Possibility of Rearranging an Acyl-β-alkyl-hydroxylamine. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 169-75 (1922-3).

Ph. D. Dissertation of Earl C. Gilbert. Molecular Rearrangements of Hydrazine Derivatives. IV. The Rearrangement of Benzoylhydrazine, Dibenzoylhydrazine, and Azodibenzoyl. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 177-82 (1922-3).

Ph. D. Dissertation of Arthur Preston Locke. Arsenical Derivatives of Phenylacetic Acid, With a discussion of a Theory of Diazotization and Syntheses by means of Diazo Compounds. II. The potentiometric Estimation of Arylamines. (Typewritten). Abstract in Univ. Chicago Science Series, *1*, 203-6 (1922-3).

Ph. D. Dissertation of Julian Francis Smith. Rearrangement of Hydrazine Derivatives. III. Rearrangement of Benzophenonehydrazone and of Triphenylmethylhydrazine. (Typewritten.) Univ. Chicago Science Series, *1*, 235-9 (1922-3).

Ph. D. Dissertation of James Kidder Stewart. The Molecular Rearrangement of Diphenylmonobiphenylmethylchloroamine. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 247-52 (1922-3).

Ph. D. Dissertation of Stewart Duffield Swan. The Velocity of Saponification of Ethyl Formate by Trimethylammoniumhydroxide in the presence of Trimethylammonium Salts. Abstract in Univ. Chicago Science Series, *1*, 253-6 (1922-3).

1923

A Theory of Color production I; II. Inorganic Compounds. Proc. Nat. Acad. Sci. *9*, 303-12.

The future Independence and Progress of American Medicine in the Age of Chemistry (With others). 80 pp. The Chemical Foundation, Inc. New York.

Ph. D. Dissertation of Archibald Turner McPherson. The Electromerism of Bromine Chloride. I. The addition of Mixtures of Bromine and Chlorine to Cinnamic Acid. (Typewritten.) Abstract in Univ. Chicago Science Series, *1*, 207-11 (1922-3).

Ph. D. Dissertation of Marion Gabriel Frank. Experiments to Prepare Mercury Derivatives of Methylene Blue. (Typewritten.) Abstract in Univ. Chicago Science Series, *2*, 113-7 (1923-4).

Ph. D. Dissertation of Leslie Hellerman. A study of Rearrangements of Halogenamine Derivatives in Anhydrous Media. (Typewritten.) Abstract in Univ. Chicago Science Series, *2*, 125-9 (1923-4).

Ph. D. Dissertation of Mary Lura Sherrill. I. Reaction of Bromonitromethane with Aromatic Compounds in the presence of Aluminum Chloride—a Case of Electromerism. II. The preparation of Pure Methylene-di-salicylic Acid. (Typewritten.) Abstract in Univ. Chicago Science Series, *2*, 171-8 (1923-4). I. J. Am. Chem. Soc. *46*, 2753-58 (1924).

Ph. D. Dissertation of Edward Staunton West. A Study of the Molecular Rearrangements of Sym.-bis-triphenymethylhydrazine and Mono-triphenylmethylhydrazine. Abstract in Univ. Chicago Science Series, *2*, 189-94 (1923-4).

1924

Ph. D. Dissertation of Chang-Kong Chuang. Stereoisomeric Hydrazone, $RR'C{:}N.NH_2$. (Typewritten.) Abstract in Univ. Chicago Science Series, *3*, 111-118 (1924-5).

Ph. D. Dissertation of Barclay Lincoln Jones. Derivatives of Nile Blue A. On the Mercurization of Nile Blue A. (Typewritten.) Abstract in Univ. Chicago Science Series, *3*, 143-48 (1924-25).

Ph. D. Dissertation of Margaret Fitch Wilcox McPherson. Derivatives of Phenyl-butyric Acid. (Typewritten.) Abstract in Univ. Chicago Science Series, *3*, 155-61 (1924-5).

Ph. D. Dissertation of Karl Stone Means. A Study of the Velocity Constant for the Saponification of Ethyl Formate. (Typewritten.) Abstract in Univ. Chicago Science Series *3*, 163-9 (1924-5).

1925

Chemistry in the Service of Man. 23 pp. A Booklet published by the Committee on the Development of the University of Chicago. Univ. Record, *11*, 1-12.

A Theory of Color Production. (Address, at the Centenary of the Franklin Institute, Sept. 1924.) J. Franklin Inst. *200,* 35-49.

Ph. D. Dissertation of William Gustav Friedemann. I. Velocity of Saponification of Methyl Formate at 25°. II. The Hydrolysis of Sodium Cyanide, Potassium Cyanide and Barium Aspariginate at 25°. (Typewritten.) Abstract in Univ. Chicago Science Series, *4,* 81-6 (1925-6).

Ph. D. Dissertation of Israel Morris Levine. The Mercuration of Neutral Red and its Sulfonic Acid. (Typewritten.) Abstract in Univ. Chicago Science Series, *4,* 105-10 (1925-6).

Ph. D. Dissertation of Andrew McNally Neff. The Preparation and Rearrangement of Methyldiphenylmethyldichloroamine. (Typewritten.) Abstract in Univ. Chicago Science Series, *4,* 141-9 (1925-6).

1926

Chemistry and Recent Progress in Medicine. Dohme Lectures, 1924, pp. viii, 62, Williams and Wilkins Company, Baltimore, 1926.

Ph. D. Dissertation of Joseph Solomon Friedman. The Mercuration of Nile Blue. (Typewritten.) Abstract in Univ. Chicago Science Series, *5,* 171-5 (1926-7).

Ph. D. Dissertation of Elbert Dung Wui Ho. The Action of Phenylhydrazine on Bromohydrouracil—an Attempt to Prepare 5-Aminohydrouracil. (Typewritten.) Abstract in Univ. Chicago Science Series, *5,* 183-8 (1926-7).

Ph. D. Dissertation of Mary Eugenie Maver. The Preparation, Rearrangement and Reduction of β-Methyldiphenylmethylhydroxylamine. (Typewritten.) Abstract in Univ. Chicago Science Series, *4,* 111-6 (1925-6).

Ph. D. Dissertation of John Demetrius Xanthopoulos. Rearrangement of Stereoisomeric Hydrazones. (Typewritten.) Abstract in Univ. Chicago Science Series, *4,* 195-201 (1925-6).

Ph. D. Dissertation of Hoylande Denune Young. Stereoisomeric Bromoimino Ketones. (Typewritten.) Abstract Univ. Chicago Science Series, *4,* 203-7 (1925-6).

1927

Ph. D. Dissertation of Mabelle Crystale Dame. I. The Preparation and Rearrangement of Phenyldibiphenylmethylchloroamines. II. An Attempt to Effect Rearrangement of Triphenylmethyl-β-methylhydroxylamine by heat. (Typewritten.) Abstract in Univ. Chicago Science Series, *5,* 163-9 (1926-7).

Ph. D. Dissertation of Harold Lawrence Mason. A Study of Tautomeric Chlorimidophenols; A Contribution to the Theory of Color Production in Dyes. (Typewritten.) Univ. Chicago Science Series, *5,* 199-203 (1926-7).

Ph. D. Dissertation of Irving Elkin Muskat. The Mechanism of Substitution in the Aromatic Nucleus. Direct Addition in the Benzene Ring. (Typewritten.) Abstract in Univ. Chicago Science Series, *5*, 217-21 (1926-7).

Ph. D. Dissertation of Walter Charles Russell. The Electromerism of Bromine Chloride. II. The Reaction of a Bromine-Chlorine Mixture with Diphenylketene. (Typewritten.) Abstract in Univ. Chicago Science Series, *5*, 233-8 (1926-7).

Ph. D. Dissertation of James Bernard Culbertson. A Study of Tautomerism of Aromatic Ketimines. (Typewritten.) Abstract in Univ. Chicago Science Series, *6*, 135-42 (1927-8).

1928

The Department of Chemistry. Univ. Record, New Series, *14*, 236-9.

Ph. D. Dissertation of Arthur Edward Remick. The Velocity of Saponification of Methyl and Ethyl Formates at 25°. (Typewritten.) Abstract in Univ. Chicago Science Series, *6*, 171-9 (1927-8).

Ph. D. Dissertation of Dell S. Garby. Arsenic Derivatives of Phenylam inoacetic Acid. II. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 159-63 (1928-9).

Ph. D. Dissertation of Luther Orland Leach. The Relative Polarity of the Halogens in the Halo-Acetic Acids. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 171-6 (1928-9).

Ph. D. Dissertation of Dorothy Virginia Nightingale. Studies in the Murexide and Alloxantine Series. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 177-82 (1928-9).

Ph. D. Dissertation of Willis Kuhn Weaver. Rearrangements of Methyldiphenylmethylmonochloroamine and Methyldiphenylmethylazide. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 203-8 (1928-9).

Ph. D. Dissertation of Oden Elbridge Sheppard. An Attempt to Prepare Tautomeric Indophenols. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 197-202 (1928-9).

1929

The Past and the Present. Univ. Record, *15*, 67-72.

Address: Priestly Medal Award to Francis P. Garvan. Ind. Eng. Chem. *21*, 897.

As Editor, Chemistry in Medicine, The Chemical Foundation, Inc. 1928, 757 pp., 25 illustrations. Chemical Publishing Co., N. Y.

Ph. D. Dissertation of Maurice Leon Cohn. Rearrangements of Dimethylphenylmethyldichloroamine, Dimethylphenylmethylmonochloroamine, and β-Dimethylphenylmethylhydroxylamine. (Typewritten.) Abstract in Univ. Chicago Science Series *8*, 71-5 (1929-30).

Ph. D. Dissertation of John Elton Cole. The Product of the Action of Phenyl Magnesium Bromide on Acetophenone oxime: β, β-diphenyl-β-hydroxyethylamine. (Typewritten.) Abstract in Univ. Chicago Science Series, *7*, 145-50 (1928-9).

Ph. D. Dissertation of William Elias Sturgeon. I. A Study of the Product of the Action of Phenyl Magnesium Bromide on Propiophenoneoxime: 1, 1-diphenyl-1-hydroxy-2-aminopropane. II. A Further Study of the Action of Phenyl Magnesium Bromide on Acetophenoneoxime: 1, 1-diphenyl-1-hydroxy-2-aminoethane. Abstract in Univ. Chicago Science Series, *8*, 145-51 (1929-30).

1930

Laboratory Courses by Correspondence. National Univ. Extension Assoc. Proc. *15*, 132-3.

A Comment on Home Study. National Univ. Extension Assoc. Proc. *15*, 38-9.

Ph. D. Dissertation of Ferris Bertrand Crum. Studies in Hydrolysis of Nitrogen Chloride and Nitrogen Bromide Derivatives (Typewritten). Abstract in Univ. Chicago Science Series, *9*, 41-47 (1930-2).

Ph. D. Dissertation of Charles William Lenth. The Molecular Rearrangement of β, β-diphenyl-β-hydroxy-ethylamine. Abstract in Univ. Chicago Science Series, *8*, 101-7 (1929-30).

Ph. D. Dissertation of Frederick Madison Meigs. The Action of Organic Halides on the Alkali Metal Salts of the Alcohols (Typewritten). Univ. Chicago Science Series, *8*, 125-31 (1929-30).

Ph. D. Dissertation of Minette Dorothea Newman. Mercuration in the Triphenylmethane Series of Dyes. Mercuration of Aurin. (Typewritten). Abstract in Univ. Chicago Science Series, *8*, 133-8 (1929-30).

Ph. D. Dissertation of Frederick Charles Maxted Smithson. Reactions of Hypochlorous Acid on Substituted Aromatic Amines, and on Cinnamic and Crotonic Acids. (Typewritten). Abstract in Univ. Chicago Science Series, *8*, 139-44 (1929-30).

Ph. D. Dissertation of Harold Herbert Tucker. A Study of 2-Chloro-3-bromoindophenol. (Typewritten). Abstract in Univ. Chicago Science Series, *8*, 153-7 (1929-30).

Ph. D. Dissertation of Ruth Maude Watts. Studies in the Introduction of the Arsonic Group ortho to the Amino group in Benzene Derivatives. (Typewritten). Abstract in Univ. Chicago Science Series, *9*, 81-7 (1930-2).

Ph. D. Dissertation of Russell Blauch Cooper. The Pinacol-Pinacolone Molecular Rearrangement. (Typewritten). Trans., Ill. State Acad. Sci. *25*, 173 (1933). Abstract in Univ. Chicago Science Series, *8*, 77-82 (1929-30).

1931

The Role of Chemistry in Medicine. The Courier of I. C. F. N., *3*, No. 9; 15-18.

Ph. D. Dissertation of John Benjamin Cloke. I. The Formation of Pyrrolines from γ-Chloropropyl and Chloropropyl Ketimines. II. A Study of the Relationship between the Structures of Cyclopropyl Ketimines, their Stabilities in Water, and their Strengths as Bases. (Typewritten.) Abstract in Univ. Chicago Science Series, *9*, 33-40 (1930-2). I. J. Am. Chem. Soc., *51*, 1174-87 (1929).

Ph. D. Dissertation of John James Hoffmann. The Theory of Substitution in Benzene Derivatives. The Action of nitrous acid on Phenolic Ethers. (Typewritten.) Abstract in Univ. Chicago Science Series, *9*, 49-55 (1930-2).

Ph. D. Dissertation of Agnes Ethyl Sharp. A Study of the 1, 2-Dihalophenylethanes. (Typewritten.) Abstract in Univ. Chicago Science Series, *9*, 67-71 (1930-2).

Ph. D. Dissertation of Spencer Gordon Stoltz. Molecular Rearrangements of Alkylarylmethylamine Derivatives. (Typewritten.) Abstract in Univ. Chicago Science Series, *9*, 73-80 (1930-2).

Ph. D. Dissertation of George Washington Ayers, Jr. The Pinacol-Pinacolone Rearrangement; The Rearrangement of the Tetramethylene Halohydrines. (Typewritten.) Brief account by Julius Stieglitz, Russell B. Cooper and George W. Ayers, Jr. Trans. Ill. State Acad. Sci., *25*, 173 (1933).

1932

Ph. D. Dissertation of Kenneth Howard Adams. The Pinacol-Pinacolone Molecular Rearrangement. I. The Rearrangement of Pinacol and of Tetramethylethyleneenechlorohydrin. II. The Rearrangement of β-Aminotetramethylethanol. (Typewritten.)

Ph. D. Dissertation of Benjamin Leo Maizel. A Study of the Interaction of Cyanogen Bromide and unsaturated Compounds, Especially of the Enolic Type. (Typewritten.)

Ph. D. Dissertation of Kenneth Nielsen Campbell. A Study of the Action of the Grignard Reagent on Aromatic Oximes. (Typewritten.) Lithoprinted in a private edition distributed by Univ. Chicago Libraries, 1935.

Ph. D. Dissertation of Raymond Wright Johnson. The Velocity of hydrolysis of Stereoisomeric Hydrazones and Oximes. (Typewritten.) Private edition distributed by Univ. Chicago Libraries, 1934, also J. Am. Chem. Soc., *56*, 1904-8 (1934).

Ph. D. Dissertation of Walter Sigmund Guthmann. I. Molecular Rearrangement of N-Triphenylmethyl-O-alkyl Hydroxylamines. J. Org. Chem. *1*, 31-7 (1936). II. The interaction of Ether and Phosphorus Pentachloride. J. Am. Chem. Soc., *54*, 2938-40.

1933

Chemistry and Recent Medical Progress (Science Service Radio Talk). Sci. Mo., *37*, 451-3.

Chemical Studies of the Mechanism of the Narcosis Induced by Hynotics. I. The Synthesis of Colored Derivatives of Phenobarbital. (With Mary M. Rising and John R. Shroyer). J. Am. Chem. Soc., *55*, 2817-20.

Richard Willstätter, Leader in Organic Chemistry (An Address). Chem. Bull., Chicago, *20*, 173-7.

The Nature of Chemical Processes. Chapter 5, pp. 117-169, The Nature of the World and of Man. Edited by H. H. Newman. Garden City Publishing Company, Inc., New York, 1933.

Ph. D. Dissertation of Eleanor Rachel Bartholomew. Some Substituted Pyrimidines. (Typewritten.) Lithoprinted, Univ. Chicago Libraries, 1936.

Ph. D. Dissertation of Paul Vernon Brower. The Pinacol-Pinacolone Rearrangement; The Rearrangement of 2-Phenylaminotetramethylethanol. (Typewritten.) Lithoprinted in private edition, distributed by Univ. Chicago Libraries, 1936.

Ph. D. Dissertation of Rachel Fuller Brown. The Molecular Rearrangement of *p*-Phenylbenzbromamide. (Typewritten.)

Ph. D. Dissertation of Gordon Hamilton Stillson. Further Studies on the Molecular Rearrangement of β, β-Diphenyl-β-hydroxyethlamine. (Typewritten). Lithoprinted in a private edition distributed by the Univ. Chicago Libraries. 1936.

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