GENESEE COUNTRY SCRAPBOOK

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The Rochester Historical Society

C. E. KENNETH MEES

Pioneer in Industrial Research

BY WALTER CLARK

DIARY OF A VISIT TO ORRINGH STONE IN 1803

BY JAMES STONE

Brighton Sesquicentennial 1814-1964

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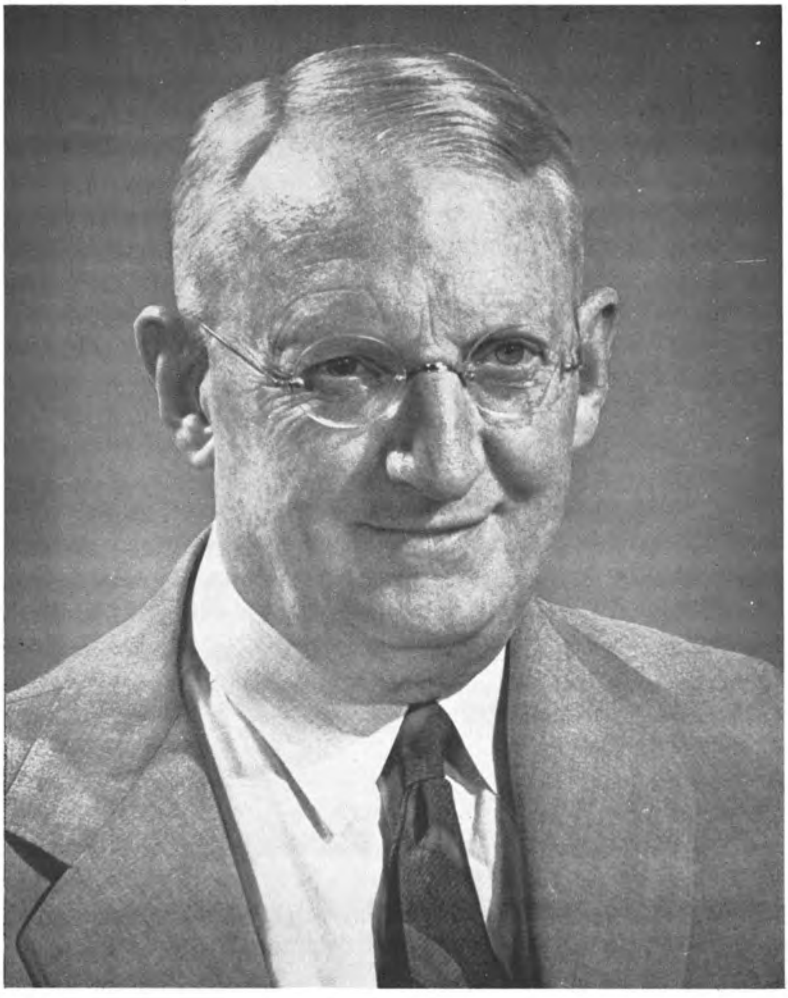
The Rochester Historical Society is proud to dedicate this issue of The Scrapbook to the Brighton Sesquicentennial, which is reaching its climax during the early Summer of 1964.

The material in this issue concerns Dr. C. E. Kenneth Mees, long one of Brighton's most distinguished residents, as well as an unusually interesting diary of a visit to the Brighton area soon after its settlement.



C. E. K. Mees

C. E. Kenneth Mees

Pioneer in Industrial Research

By Walter Clark

Photography was about sixty years old at the end of the last century. Although it was intended to be used for recording portraits and scenes, the possibility of using it as a recording medium for science was also realized from the start, and through the years it became more and more relied upon as a way of making records for observation and measurement. It was not until towards the end of the century, however, that studies were started on what is now known as "the theory of the photographic process," which embraces the relationship between the photograph and the thing photographed. Until then the scientific world had shown little interest in the science of photography as distinguished from its practice.

The science of photography deals with the physics and chemistry of light-sensitive substances, especially of silver compounds. It is concerned with the nature of the light-sensitive material, the changes occurring when it is exposed to light, the chemical actions involved when a developer is applied to bring out the image, the structure of the developed image, the faithfulness of reproduction of the brightness scale of the original subject, and so on.

The first worth-while study of the sensitivity of photographic materials, and the formulation of the rules by which the developed image is related to the original subject, were published by Ferdinand Hurter and V. C. Driffield in 1890. Their investigations, described in the *Journal of the Society of Chemical Industry,* rested in oblivion for some time. At the end of the century, however, two young students became interested in the subject, eventually found the Hurter and Driffield paper, realized its significance, and very substantially broadened its subject matter.

These students were Charles Edward Kenneth Mees and Samuel Edward Sheppard. Both were at St Dunstan's at Catford and both went to University College, London, where they passed their B.Sc. and D.Sc. degrees for work on the theory of the photographic process. They then separated, Sheppard having been awarded one of the 1851 Exhibition Scholarships, on the strength of which he went to Marburg with Karl Schaum and to The Sorbonne with Victor Henri. Mees continued in photographic research and the application of photography to scientific and technical investigation, and also became a pioneer in the application of science to the problems of industry. Sheppard joined Mees again later to investigate for the rest of his life many of the fundamental aspects of the photographic process.

Charles Edward Kenneth Mees was born on 26 May 1882, at Wellingborough, Northamptonshire. He was the eldest child, and had two brothers, and a sister who died in infancy. His father was a Wesleyan minister with a Bachelor of Arts degree from London University. His mother, Ellen Jordan, had a number of Wesleyan ministers among her ancestors.

Since a Wesleyan minister retained a church for only three years, his family did not acquire a rooted attachment to one locality, and Mees never returned to Wellingborough after he left it when he was one year old. The family moved to Ipswich, then to Colchester, and then to Hythe when Mees was seven. Here he started school. He had already been taught the elementary subjects by his family, and was particularly fond of reading history, biblical for the most part, and he stated that he had no difficulties therefore in coping with the work of the small schools.

"A child in a Wesleyan minister's household receives a very thorough training in the literature and history of the Bible, which produces a permanent impress on literary style. At the same time, circumstances are such that the child learns early to speak in public, as a result of which I have never known any form of stage fright and have always been prepared to say what I had to say without hesitation."

When Mees was ten, at Barnet Grammar School, it was discovered that he was very shortsighted, a fact which explained his difficulty in following class work. He was, however, introduced to science in the form of elementary chemistry, read books on it, fixed up a small laboratory at home, and had no difficulty in leading his class in chemistry. He was a weakly child, not interested in boys' school games and outdoor life, and turned to books and the French language. In 1894 he went to Kingswood School in Bath, a school which had been established by John Wesley for the sons of Wesleyan ministers. "The school was excellent from an educational standpoint but proved very bad for me physically. Because of the poor food, I suffered from dyspeptic indigestion, which has been a nuisance ever since."

Since Mees did not mix too well at that time with the other students, he found himself left to his own devices and gravitated to the laboratory. In the three and a half years that he was at Kingswood he acquired a good knowledge of elementary chemistry, especially qualitative analysis, and he expanded his laboratory at home. The headmaster at Kingswood thought there was a danger of Mees becoming too specialized in chemistry, although this had no effect on Mees's views. However, the classical master introduced him to the study of the variant readings of the New Testament in Greek. This was the only classical subject in which he became interested and of which he retained any memory. Later in life he was greatly interested in archaelogy but he could not relate it to his classical studies at school.

Attacks of illness continued, diagnosed as "rheumatism owing to climate," and so in 1897 he was transferred to Harrogate College, a private boarding school. He felt that the teaching was inferior, although the climate, accommodation, and food were better, but the training he had had at Kingswood made it easy for him to pass the London matriculation examination in June, 1898.

Mees's family then moved to Croydon where his father was Chaplain of the Guards' Depot at Caterham. This made it convenient for him to attend as a day student St Dunstan's College, Catford, a technical school. C. M. Stuart, the headmaster of St Dunstan's, was a chemist and a pupil of Fittig, and with Mees' father he decided that Mees should go to University College, London, and do chemistry under Sir William Ramsay. In 1899 Mees entered his name for the Andrews Scholarship examination at University College, as well as for the Intermediate B.Sc. of London. He passed the Intermediate, second class, but failed to get the scholarship. Ramsay said he was too young in any case and must wait another year before entering his classes.

Mees now had a good laboratory at home and, at Stuart's suggestion, started some research on a project in which he was not interested, an organic synthesis, but at least it helped him to resolve problems in his own way. In 1900, Mees obtained the Andrews Scholarship, together with an extra one from Ramsay, who looked through his notebooks, said he had done all the routine practical chemistry required for the Bachelor's degree, and that he could start to teach him to do research.

He was assigned as an assistant to E. C. C. Baly, who was photographing the spectrum of the iron arc with a 10-foot Rowland grating in connexion with the study of the spectra of the rare gases. This was his introduction to scientific photography, although a great deal of his time the first year was taken up with classes in chemistry and physics. H. M. Callendar was the Professor of Physics and his lectures had a great influence on Mees, particularly in connexion with the detection and evaluation of errors. He did a good deal of physics laboratory work under A. W. Porter and H. Eumorfopoulos, since physics was his subsidiary subject. Mees's outstanding contact at University College, of course, was with Sir William Ramsey whom he regarded as an inspired and inspiring teacher. Lord Rayleigh and Ramsey had discovered argon and Ramsay and Travers had identified the noble gases of the atmosphere—helium, neon, argon, krypton, and xenon. The environment was steeped in the noble gases. Norman Collie was the Professor of Organic Chemistry and predicted that the bright red glow produced by an electrical discharge through neon would one day be used for street lighting. The new work on radium emanation was starting and the students were proud to be allowed to help Ramsay in operating the Toepler pumps.

Mees's contact with the scientific group at University College in the early years of the century produced a profound effect on his attitude to science and scientific research later on. Even though the equipment at University College was meagre and inferior, the spirit of research and study was very infectious, and it was a good place for a student anxious to spend most of his time on laboratory work.

In the summer of 1901 Mees had an illness involving an intermittent high fever which left him very weak after each attack, and it seemed doubtful if he would be able to return to college. "The doctor said it was due to overwork, which was certainly incorrect."

Ramsey felt that Mees was probably working too hard for the Honours B.Sc. degree. At the same time Ramsey was a strong agitator at the Senate of the University for students being granted degrees for their research, and the first students approved by the Board of Studies of London University to enter for the B.Sc. degree by research were Sheppard and Mees. They had been interested in the theory of photography and Ramsey suggested it would be a suitable subject for a research thesis. Practically nothing in the books on photography made use of the physical chemistry of the time, and Mees's professors and fellow students also knew practically nothing of the subject. Sheppard, who was a very good searcher of scientific literature, turned up the Hurter and Driffield paper of 1890 which was entitled "Photochemical investigations and a new method of determination of the sensitiveness of photographic plates," and this came as a revelation to the two students, for here were people who had really studied photography scientifically. They had found a way of measuring the image produced by exposure to light followed by development, and of measuring the rate of development of the exposed image. Here was a model for the attack on the nature of the photographic process.

The Hurter and Driffield apparatus was unique but rather primitive, and the advances in physical chemistry since 1890 enabled Sheppard and Mees to improve on their experimental methods. Mees wrote in his thesis in 1903, "In view of this divergence in the methods and theories at present in use . . . I deemed it necessary to largely repeat the work of Hurter and Driffield, considerably amplifying it, and, wherever possible, making it more accurate." Sheppard and Mees did this and both got their Bachelor of Science degrees by research in 1903. Their theses included repeating and extending the investigations of Hurter and Driffield, and in particular studying the general kinetics of development and especially the determination of the velocity of development.

They had built a sector-wheel exposure machine, a developing thermostat from a bucket, and a standard light source in the form of an acetylene burner, which gave Mees "a great respect for acetylene." This burner remained in use as a practical standard in sensitometry until the early thirties. To measure densities they used a Hüfner spectrophotometer borrowed from E. H. Starling, Jodrell Professor of Physiology. (It is understood that he had borrowed it from Guy's Hospital, so its origin is not clear. Mees later redesigned the spectrophotometer with Frank Twyman and used the new instrument in later work. It was made by Adam Hilger.)

"It was really only an orientation of the field, but the work we had done in two years was sufficient to show us that much work could still be done, and we felt that by then we knew how to do it. Again, we both suffered and gained by the fact that nobody around us knew anything about the subject, and that we had to work out all of it. The general opinion at University College was probably that we were extremely eccentric and rather undesirable students." It is understood that Eumorfopoulos used to refer to them as "the heavenly twins."

Mees's first scientific publication was in 1902 in *Chemical News* and was actually nonphotographic. It was, however, from the Chemistry Laboratory of University College and dealt with a modification of Schrötter's CO_2 apparatus.

Mees was anxious to start a career and earn a living but his father felt he should continue research work and take the D.Sc. before leaving college. It seems probable that Ramsay supported this. It was decided that Sheppard and Mees would continue their collaborative research with entirely new and efficient apparatus.

There was not adequate space at University College for photographic work on the desired scale. Mees, therefore, built a laboratory at home at Caterham and Sheppard at his home at Catford. Ramsay stipulated that he should inspect these home laboratories once a year ("a very pleasant and memorable event") and that Sheppard and Mees should continue as internal students, reporting periodically on the progress of their work. They each spent about two hundred pounds on their equipment.

The work of the next three years led to the theses for the D.Sc. degree. The investigations were first concentrated in the field of sensitometry, and were extended to include the statics and kinetics of development, including the chemistry of the ferrous oxalate developer, the microscopic structure of the developed image, the theory of fixation, and the effect of oxidizing agents on the latent image. Eleven papers were published between 1904 and 1907 by the Royal Photographic Society, the Chemical Society and the Royal Society. They formed the basis for the doctorates and for a book which is still a classic in its field, *Investigations on the theory of the photographic process* (known as "Sheppard and Mees").

Sheppard was awarded the 1851 Exhibition scholarship and went to the continent. Mees had always intended to be a teacher—not a professor but a schoolmaster. It seemed to him that English schools should give more weight to the teaching of science, the greatest teachers at that time being in the field of the classics. His reasoning was that, if a man devoted to research would become a schoolmaster, he might influence some of the more promising students to go into science instead of following the teachers of the classics or mathematics. Mees was devoted to experimental science and confident of his ability to inspire other people. He felt that with the prestige of his doctorate he should be able to get a good position as a schoolmaster, and perhaps ultimately a headmastership.

Ramsey, however, had other views. He was convinced that there was a great need for scientific men in British industry, and that a student who showed ability for research in a practical field should go into industry. He, therefore, urged Mees very strongly to try to get an industrial position, and, in view of Mees's experience and competence in the field of photographic research, he suggested the photographic industry.

Even before he went to University College, Mees felt that one purpose for being on earth was to increase knowledge, and that it was well worth while for a man to study science. When he was about twenty years old, he began to be conscious of the possible applications of science to economics. He was impressed by the study of economics of London which had been made by Charles Booth, became a Socialist, began to meet other Socialists, and joined the Fabian Society, partly as a result of the influence of H. G. Wells. At that time he was, however, reading the writings of Francis Bacon and became impressed by two of Bacon's ideas, namely, that "knowledge comes from observation and experiment, and the other, that the science that people were acquiring might be applied to increase the wealth of man." These ideas struck him very strongly, and he realized that the important thing was the acquisition of knowledge, and the next most important thing was the application of knowledge to industry, so that the poverty in the country could be relieved. It seemed to him that by applying science to industry he could help increase the total amount of wealth, rather than redistribute it. He then gave up Socialism, and for the rest of his life devoted himself to experimenting on a large scale on the application of scientific research to the problems of industry, and specifically to an attack on the problems of photographic science.

Ramsay had convinced Mees that he should go to the photographic industry, so he went to a friend, S. H. Wratten, who was the active manager of the old but small private firm of Wratten and Wainwright, at Croydon, and asked if he would give him a job. He wanted to do scientific research with a view to improving photographic products and processes. The result was that Wratten and his father incorporated the company, gave Mees twenty-five per cent of the stock for £1250, and made him joint managing director. He started on 3 April 1906.

One of the first things that Mees did at Wratten and Wainwright was to work on colour sensitizing the Wratten plates by means of "sensitizing dyes." Such dyes had been applied to plates by means of a bathing technique by the Farbwerke Hoechst (Meister, Lucius and Brüning) in Germany, and the

English agent of the firm suggested to Wratten that he should make plates sensitized in the same manner, because some English customers were complaining. When the problem was put to Mees, he realized that the proper thing to do was to incorporate the dye in the emulsion before coating on the glass, and this resulted in the production of plates which were superior to the German plates. Improvement in the plates, particularly by use of the dyes Pinachrome and Pinacyanol, resulted in the marketing of the "Wratten Panchromatic Plates" which were a great success almost at once, putting the Wratten and Wainwright firm into a leading position as the source of supply of colour-sensitive plates. Mees found in Germany a new dye called "Filter Yellow K" with which he made light filters which became the "Wratten K Filters." Tartrazine had been used previously but it had a transmission in the near ultraviolet and its absorption was not very sharp. The new dye resulted in the production of the yellow filters which have been standard ever since.

With the increasing use of panchromatic plates, a large number of other colour filters became necessary, particularly for the photomechanical reproduction field, and, with A. J. Newton of the Bolt Court School of Engraving and Lithography, Mees worked out a standard set of tricolour filters which have been well known since as Wratten A, B, and C tricolour filters. A visit to Hoechst yielded a large number of dyes which were not generally available and Mees made a systematic study of their absorption spectra, and published them in *An atlas of absorption spectra,* which was put out in London in 1909. This study formed the basis for the development of a wide range of light filters.

The spectra were photographed in a wedge spectrograph which was a small diffraction-grating spectrograph, over the slit of which was fitted a wedge of black glass which varied the intensity from one side of the spectrum to the other. The spectrum was photographed on panchromatic plates in the instrument and showed the colour sensitivity curves of the plates. The instrument was later marketed by Adam Hilger. The absorption spectra of dyes could be photographed by placing a wedge-shaped cell containing the dye solution over the slit.

In addition to the range of Wratten filters, a group of "safelights" were developed, which were essentially light filters used over lamphouses, to provide in darkrooms illumination by which the products of varying spectral sensitivity could be handled safely.

The Wratten and Wainwright Company had very little money for advertising, so Mees put out technical booklets which would give people information on how to use photographic materials. Instead of advertising the materials, he advertised the booklets. Mees was thus a pioneer in the publication of what are now known as data books, instruction manuals, and technical booklets.

Mees had a certain amount of time to do research, although it was technological rather than scientific. He worked, for instance, on the Lumière Autochrome Plate, which had been put on the market in 1907, and made a study of materials for direct-colour photography. In 1908 he opened up a new field of photographic research with the study of the resolving power of photographic materials, as a result of which the first paper on this subject was published in the *Proceedings of the Royal Society.* This study resulted in the development of plates of increased resolving power relative to their speed, and these were put on the market as "Process Panchromatic Plates" which were widely used for preparing colour-separation negatives from coloured originals for making halftone printing blocks. The new panchromatic plates were of interest not only in commercial photography and photoengraving but also in spectroscopy and astronomy, and at that time Mees formed some of the connexions with these fields which he continued for the rest of his life. At the end of two years he had put out a long line of new photographic products, most of which were eminently suited for use in scientific work, especially in spectroscopy and astronomy.

In 1909 Mees visited the United States to assist the American Bank Note Company as a consultant on problems relating to counterfeit banknotes. During this time he visited George Eastman, the founder of the Eastman Kodak Company at Rochester, N.Y., and saw the Kodak Park Works. In 1910 he was consultant to the Cotton Powder Company, of Faversham, concerning the stability of nitro-cotton explosives. In 1911, Nobel's Explosives Limited used his consulting services in connexion with the stability of cordite. At the beginning of 1912 Mees received a telephone message from Thacher Clarke of Kodak Ltd. Clarke was Eastman's personal assistant and correspondent in Europe, and he told Mees that Eastman would like to repay the visit he had made him, by visiting the Wratten and Wainwright factory in Croydon. There Mr. Eastman was shown the factory and the work they were doing on panchromatic plates and colour filters. Eastman had already come to the conclusion that, although a good deal of experimental work had always been done by his company in the United States, a separate scientific research laboratory was needed which would devote itself to the fundamental theory of photography. Eastman told Mees he would like him to go to Rochester, and Mees agreed on the condition that Eastman bought the Wratten company. Eastman was agreeable, arrangements were made for the incorporation of the Wratten company into Kodak Ltd. in England, and Mees went to the United States in April, 1912, to work out plans for the Kodak Research Laboratory. Under his guidance, it was to become one of the world's great industrial research laboratories. The first members of the staff started work in the autumn of 1912.

At the beginning of 1913 the laboratory had a staff of about twenty people. It now numbers well over a thousand.

Mees's old associate at University College, S. E. Sheppard, had joined the organization and later became assistant director. P. G. Nutting was the first physicist. He came from the Bureau of Standards where he had been in charge of the Division of Optics. When he left in 1917 to become director of the new research laboratory of the Westinghouse Electric Company, his place was taken by L. A. Jones, also from the Bureau of Standards. In 1913, J. G. Capstaff came from Newcastle and J. I. Crabtree from Manchester to work in photographic research. A. S. McDaniel, also from the Bureau of Standards, was put in charge of inorganic chemistry. Hans T. Clarke, the organic chemist, joined in 1914, and F. E. Ross, the astronomer, in 1915. Mees chose his staff well from the start.

The organization was not under the control of the management of the factory, and it was not intended that it should concern itself primarily with manufacturing problems. Mees pointed out that, although industrial laboratories usually deal mainly with the application of science rather than with the creation of new knowledge, in the case of photography there were no general academic sources for the advancement of the theory of the process. The research laboratory was, therefore, developed as a research institute devoted to the advancement of scientific knowledge as well as to its application to the technology of photography. From the beginning the staff was engaged in the elucidation of the theory of the photographic process. Later, of course, much effort was also spent on the practice of photography and its application to science and technology, as well as on improvements in manufacture and methods of testing and control.

His position in the new laboratory enabled Mees to realize his dream of experimenting on a large scale with the application of scientific research to the problems and ambitions of industry. He admitted that his experience as a research organizer and director were confined mainly to photographic research and to the photographic industry, but he had close connexions with other progressive directors of research in industry, including W. Rintoul, of Nobel's Explosives Ltd., and W. R. Whitney of the General Electric Company in the United States. From Rintoul he learned much about the organization of industrial research, and from Whitney ("Whitney's laboratory was not so much organized as inspired") he learned the dangers of over-organization.

In the Kodak laboratory Mees attempted to use a certain amount of formal organization but avoided over-organization, and as the years went on the lessons that he had learned were embodied in a book, *The organization of industrial research,* published in 1920, and republished in conjunction with J. A. Leermakers in a revised and greatly enlarged form in 1950. He grouped laboratories according to whether the problems investigated were connected with one common subject or whether they were of many kinds having no connecting bond of interest. The first type of laboratory might be called "convergent" and the second "divergent." His new laboratory had been organized in departments and was of the "convergent" type; that is, the work of all the departments was interconnected so that they converged on the scientific foundations of photography and on their applications in the broadest sense. In more recent years the work of the laboratory became more divergent, because it was inevitable that discoveries were made which might have commercial importance and which were not directly related to the original main purpose of the laboratory. One of the early policies established was that the scientific work was to be published in the scientific journals, and another was that the whole laboratory should be open to the men in it, and a conference system was organized whereby the whole staff could know about all the work going on.

Mees had little use for the "project system" where committees decide what shall be done, how much shall be spent, and when the work shall be dropped. He felt that the man who best knew the direction the work should take was the man who was doing it, and he tried to choose his men so that he could rely on them from this point of view. It is appropriate to quote from one of Mees's talks on research, for it typifies his attitude: "Research is a gamble. It cannot be conducted according to the rules of efficiency engineering. Research must be lavish of ideas, money and time. The best advice is, don't quit easily. Don't trust anyone's judgment but your own, especially don't take any advice from any commercial person or financial expert and finally, if you really don't know what to do, match for it. The best person to decide what research work shall be done is the man who is doing the research. The next best is the head of the department. After that you leave the field of best persons and meet increasingly worse groups. The first of these is the research director, who is probably wrong more than half the time. Then comes a committee, which is wrong most of the time. Finally there is a committee of company vice presidents, which is wrong all the time."

Sensitometry was always one of the major research fields, particularly in relation to the theory of tone reproduction, which is the study of how far photographic reproduction would resemble the original in the distribution of brightness attained, and the prediction from the sensitometric characteristics of photographic materials of their ability to reproduce tone values with fidelity. The first work was an investigation of the sensitometry of photographic papers, and this led to the general study of tone reproduction undertaken by L. A. Jones and his colleagues. This work and its corollaries essentially completed that started in 1890 by Hurter and Driffield. and the whole subject was summarized in Mees's Hurter and Driffield Memorial Lecture before the Royal Photographic Society in 1924 under the title "The photographic reproduction of tone." This work was continued by Jones in many important papers, and is still a subject of active investigation.

Mees's early work on resolving power was continued actively, and in 1924 F. E. Ross published a monograph, *The physics of the developed photographic image,* in which the subject as a whole was reviewed. The work of Ross was continued by O. Sandvik and G. Silberstein. The subject of granularity, or its subjective aspect of graininess, was actively studied, particularly by N. Deisch, A. C. Hardy, E. M. Lowry, E. W. H. Selwyn, and G. C. Higgins.

The sensitivity of the silver halide grains, the mechanism of the action of light and the nature of the latent image have been the subject of investigation by many laboratories, but the research laboratory at Rochester played a very significant part. About 1920, when the subject was also under investigation in England and Sweden, the very difficult problems involved in measuring the numbers of silver bromide grains of different sizes in film emulsions were attacked, and it was decided that the only satisfactory method of measuring the size distribution was by photomicrography, measuring the actual photographs of the grains at a magnification of 2000, and classifying them according to their sizes. Great numbers of size-frequency curves were obtained in an attempt to correlate the properties of the emulsion in terms of grain size and size frequency.

In the first five years at the laboratory, Sheppard's time was spent primarily on a study of the physico-chemical properties of gelatin, which is the medium in which sensitive photographic emulsions are prepared. This led to a great number of papers on the subject, and it culminated in 1929 in the establishment of a procedure for making a standard gelatin by methods easily reproduced in the laboratory, and a standard de-ashed gelatin was sold to biological and chemical laboratories. A series of papers was published in 1930 on the structure of sols and gels which clarified the difference between these systems and ordinary solutions. The well-known sensitizing property of gelatin in the photographic process led to a systematic study of the difference between gelatins in their sensitizing power and the nature of the substance in the gelatin which confers sensitivity. By a painstaking series of experiments it was found that the sensitizer was concentrated in the liquors obtained by the acid treatment of the raw materials left after liming the hides, and it was eventually identified as allylthiourea. This was perhaps the greatest advance made in Sheppard's scientific career, and all further studies of the photographic properties of gelatin, the nature of sensitivity, and the latent image have been conditioned by it.

Other work at this time in Sheppard's branch of the laboratory covered a great range, including photovoltaic effects—that is, the electrical response of silver halide to light—the colloidal structure of the material used for film support, the nature of development, and in particular the nature of dye sensitizing, the adsorption of sensitizing dyes to silver halides, and the structure of the adsorbed layers and their sensitizing effects. It was evident that dye sensitizing would involve not only the adsorption of the dye to the silver halide lattice, but an understanding of the nature of the absorption of light through the resonance structure of the dye. The absorption spectra of dyes in various solvents, in vapour phases, and when adsorbed to surfaces, were therefore investigated.

The work of Sheppard and others suggested that the sensitivity of the silver halide grains depends upon the existence of submicroscopic specks consisting of silver sulphide (with possibly also some silver), and that these specks act as nucleation centres for the material produced by the action of light (probably silver) which, in turn, initiates development. Sheppard's discovery of the sensitizing effect of allylthiourea indicated it could be the origin of the formation of the silver sulphide, and he and his colleagues advanced a theory of the action of light which they called the "concentration speck theory." It was suggested that the specks of silver sulphide, perhaps with silver, produced a strain in the crystal lattice, and that when light fell on the crystal it liberated photo-electrons which were transferred through the crystal until they reached the speck, where metallic silver was set free. This theory essentially provides the basis for later work by the physicists J. H. Webb of the Kodak Research Laboratories and by R. W. Gurney and N. F. Mott of Bristol, who applied the methods of quantum mechanics to explain latent image formation. Work done in Mees's laboratories on reciprocity failure also threw much light on the understanding of the formation of the latent image.

Work was done on the mechanism of development, partly by studying the structure of the developed silver by the electron microscope. A photographic developer is a reducing agent and it discriminates between exposed and unexposed silver halide by virtue of the silver specks of the latent image catalyzing the reduction of the exposed grains. The developing agent is adsorbed to the silver bromide and forms a complex which breaks down to silver in the presence of silver nuclei, a layer of electrically charged bromide ions surrounding the silver bromide crystals playing an important part in controlling the initiation of development. Much study was devoted, and still is, in the laboratory, to the reactions occurring in development and the kinetics of the reactions, both for black-and-white and for colour photography, where the oxidized developer produced during development produces dyes by reaction with couplers.

For the first five years of the laboratory, work was devoted almost entirely to the theory of photography, and it was not until 1919 that the development of new, commercial products began to assume real importance. In that year, work was started on the development of a system of amateur cinematography using narrow film. Capstaff, in particular, steered the work and followed it for many years. It was decided to process the film in the Kodak Company's own stations, and to develop simple cameras and projectors. It was also decided to use the reversal process, in which a negative is developed, the silver image is dissolved out, and the remaining undeveloped silver halide is then exposed and developed to a positive silver picture. Capstaff conceived the idea of controlling the exposure of the residual silver halide according to the amount that was left in the film after bleaching. This was a very important step in processing the film, compensating as it did for variations in exposure. The so-called "Cine Kodak Process" was put on the market in 1923. (Probably the first feature film to be made on the narrow-width film was by members of the laboratory staff. It was called "Out of the fog" and was a skit showing Mees landing on the shores of Lake Ontario near Rochester with his contingent of Britishers to start the laboratory.) A development from this was the Kodacolor system of amateur cinematography in colours, which was derived from an invention of R. Berthon and which was made available to the public in 1928. It was an additive colour process using lenticular film. Amateur cinematography in colour continued to be done by this process until the new Kodachrome film was put out in 1935.

From the beginning Mees had set as an objective the working out of an amateur colour photographic process. Before he went to Kodak he had been interested in the so-called additive-screen plate processes and continued his work in Rochester, but it was eventually abandoned. The so-called subtractive colour processes at that time were difficult to do, and in 1914 Capstaff started work on a two-colour subtractive process particularly for portraiture. Results were actually shown under the name of "Kodachrome" in 1915 at the San Francisco Exhibition, but the process never really reached commercial acceptance. The work, however, was carried on experimentally for the professional motion picture field, although eventually it was essentially replaced by the three-colour imbibition process of the Technicolor Motion Picture Corporation, and later that was largely displaced by the present negative-positive colour films.

Ever since the early days at Croydon, starting with the preparation of the Wratten panchromatic plates, Mees had been interested in sensitizing dyes for making plates and films respond to all the visible spectrum. During the war of 1914-1918, when the only source of such dyes (Germany) was cut off, Mees started H. T. Clarke on their preparation in Rochester. Following successful preparation of the early dyes, attempts were later made to make new ones and a prolonged investigation was started. It was not until 1928 that it was realized in the Kodak laboratories that heterocyclic bases, other than those of the quinoline series, could be used for making polymethine dyes similar to the cyanines of which the early sensitizers were examples. A few of the newer cyanine dyes had been made by W. H. Mills and his associates in Sir William Pope's laboratory at Cambridge, but they had not been applied widely to the commercial production of photographic materials. In 1928, a number of dyes were made in Rochester from benzotriazole which proved to be very satisfactory sensitizers for the green and orange portions of the spectrum, and following these, dyes from the naphthathiazoles proved to be the best sensitizers for the red discovered up to that time. This work was under L. G. S. Brooker who had been at King's College, London, and who first worked with Clarke on sensitizing dyes in Rochester. After this, the organic chemists made several hundred new sensitizers a year and Mees established the system of evaluating them. Out of this work has come a great variety of photographic materials for special purposes. The sensitivity of films to tungsten filament lamps was greatly increased and new sensitizers increased the speed of fine-grained emulsions to a greater extent than that of coarse-grained emulsions; this was very largely responsible for the big increase in the use of miniature cameras. It was not long before most of the negative materials, and many of the photographic printing papers used commercially, employed the new sensitizing dyes which resulted from the extensive investigation prompted by Mees.

About 1920, Mees came into contact with Leopold D. Mannes and Leo Godowsky, two young men who were musicians by profession but who were enthusiastic amateur experimenters in colour photography, and for them he made experimental coatings for their work. Mees had run into a number of dishonest "inventors" in the colour field, and was much impressed by the sincerity of these men. As a result of the availability of new sensitizing dyes, it seemed probable in 1930 that a process on which Mannes and Godowsky were working might be developed into a practical method of colour photography, but it was clear that close co-operation would be needed with the research laboratory and, especially, with the emulsion research group. Mannes and Godowsky were, therefore, invited to join Mees's laboratory staff and to continue their work. The new Kodachrome process was developed and the first Kodachrome film was put on the market in 1935 as 16mm amateur cinematograph film. From this work developed a system of making colour prints on white support by the Kodachrome process, and a negative-positive process which was introduced under the name of Kodacolor; later a variety of other related colour systems were evolved. Colour photography became a large and important part of the photographic industry.

The work on sensitizers and parallel work on other aspects of the technology of preparing photographic emulsions made it possible to improve photographic materials for scientific work, notably in astronomy and spectroscopy. Mees personally became very interested in astronomy, and was directly responsible for some of the great progress made in astronomy in the last thirty years. He undertook to work out new plates for astronomical study. In 1912, while Mees was still at Wratten and Wainwright, but after he had agreed to come to Rochester, he had had a visit from F. H. Seares of Mount Wilson Observatory. Seares told him that G. E. Hale had asked him to invite Mees to go to Mount Wilson and install a laboratory for making plates specially for astronomical work, because he believed that considerable improvement could be made. Mees told Seares that he had already agreed to come to Rochester to organize the research work of the Eastman Kodak Company, but promised that as soon as possible he would make special plates in Rochester for the astronomers. Finally, from 1933 on, in a new emulsion research laboratory which Mees had established in 1931 under C. J. Staud (later Mees's successor as director of the Kodak Research Laboratories), he was able to develop a large series of plates sensitive to a wide range of spectral bands in the visible and near infra-red, and having many types of sensitivity, contrast, and graininess. These were of great value to the observatories, and Mees was able to redeem the promise that he had made to Seares. The work was recognized by the award of the Henry Draper Medal of the National Academy of Sciences.

The establishment of the emulsion research laboratory under Staud in 1931 represented an enlightened departure from tradition in the photographic research field, for emulsion making is the main prop of the photographic industry, and its secrets are carefully guarded. Some technological rather than scientific work was done in the emulsion-making department which was established as part of the original laboratory, and some physico-chemical studies had been made on the properties of emulsions in the chemistry department. Little progress was made in the application of science to emulsion-making methods, however, until the special laboratory was founded in 1931 and experimental work was started to cover systematically all phases of the subject. These included the synthesis of sensitizing dyes, the relation of their structure to their properties, and the mechanism by which they sensitize; study of non-sensitizing dyes for photographic purposes, such as protection against halation; chemicals to be added to emulsions to give them special properties, including antifoggants, preservatives for ensuring good keeping properties, and hardeners; methods of chemical sensitizing derived from the original work of Sheppard on sulphur compounds; the special problems of colour photography; and, particularly, the technology of emulsion making. All this work has contributed to the production of new photographic materials of a great range of properties and uses.

Important results for the graphic reproduction fields have come from the special departments which Mees established to study the problems involved in the reproduction of photographs by the various printing processes, and in copying documents for disseminating the information in them rapidly, cheaply, and accurately, for reducing the storage space, for security, and for effectively increasing their life. The photographic aspects of sound recording were studied systematically after 1932 and the results were made available to the motion picture industry. When the laboratory was first established, a room was equipped for experiments in radiography, and X-ray research has been an important function ever since, embracing the sensitometry of X-ray materials, the properties of intensifying screens, the reduction of scattered radiation, improvements in medical and industrial radiographic technique, soft X-ray radiography, X-ray motion pictures, and X-ray crystal analysis.

The characteristics of a photograph depend on the kind of emulsion and on the nature of development. The two are closely interdependent. Mees had studied the laws of development since his start in research, and when he founded the laboratory he included a department for investigating the practical aspects of development and working out formulae for developers, and for studying the other aspects of "processing," which includes fixing, washing, drying, stabilizing, bleaching, intensifying, toning, and so on. The work was essentially of a practical nature, and was extended to include the design of apparatus in which processing could be performed on a continuous, large-scale basis.

During the World War of 1914-1918, starting particularly in April 1917 when the United States declared war on Germany, Mees devoted the efforts of his laboratory largely to military problems. Work was done on the production of graticules, on colloidal fuels of pulverized coal for the Navy, on aerial photography (in particular the penetration of haze), on the camouflage of ships at sea, and a variety of other subjects. In March 1918 a school of aerial photography was started in Rochester for the Air Corps, using the laboratory staff as instructors. The course was planned in collaboration with the military authorities, but especially with Captain Harry Wilsden, of the Royal Flying Corps. A total of 1995 men was graduated. The laboratory's efforts were paralleled on a far larger scale in the war of 1939-1945, and its facilities and knowledge have since been used to a large extent by the military people. Mees himself devoted much of his own time to some of the important problems of the last war, and was on top-level committees. In 1946, he showed the writer with great pride a gold cigarette case with King George VI's signature engraved on it, but omitted to say what he got it for.

In 1918, there was in the United States a serious lack of synthetic organic chemicals, the supply from Germany, which was almost the exclusive source, having been cut off in 1914. With Eastman's support, Mees organized a department of synthetic organic chemistry under Hans T. Clarke to supply special chemicals to research laboratories and universities. This department developed into one of the major sources of special organic chemicals for research. At the start, only 265 chemicals could be collected and made available. By 1921, 1144 chemicals were listed, of which the majority had been synthesized, and eventually over 3500 chemicals were produced. The question of research in fields external to the main purpose of a laboratory presents problems to the director of research in industry. It is easy to be diverted too much from the main work of the laboratory, but there will always be some inventions or results of research which will repay development. Mees had to make decisions as to what should be done in his laboratory outside the photographic field. The matter of the synthetic organic chemicals was one, as were also some of the special subjects worked on for the war efforts. But there were many others.

Following his work on colloidal fuel, Sheppard studied the electrodeposition of rubber at an anode from electrically charged rubber-latex particles. To the latex suspension were added other agents required in rubber manufacture, such as the sulphur, accelerator, and filler, and the electrodeposition was used for the production of inner tubes, gloves, rubber-covered wire, and other such items. A similar process had been worked out about the same time in Hungary, and a commercial firm was organized with the Goodrich Rubber Company in the United States in which the Hungarian and Kodak patents were incorporated; the resulting company, The Anode Rubber Company, has been practising production of sheet rubber materials since that time.

In 1940, the research laboratories, at the request of H. C. Urey, undertook the task of separating the stable isotopes of nitrogen, in particular the heavy isotope ^{15}N, which was needed as a tracer in biological and chemical research. The isotope was concentrated utilizing chemical exchange between ammonia and a water solution of ammonium nitrate in packed fractionating columns of very great length, cycling over periods of many months. The ^{15}N was made available commercially as nitric acid and potassium phthalimide and, in 1946, the production of ^{13}C, the heavy isotope of carbon, was started, using chemical exchange between hydrogen cyanide and a solution of sodium cyanide. The ^{13}C was sold as methanol and methyl iodide.

In 1914, the Eastman Kodak Company began to manufacture the lenses for its own cameras, using conventional optical glasses, but the computing staff eventually became interested in obtaining improved optical glasses, and discussed the matter with G. W. Morey who had done work of great value during the war in the production of optical glasses for military purposes. The main objective was to make glasses of even higher refractive index than the available barium crown glasses but with a low dispersive power. High atomic-number elements were chosen for study in silicate, borate, and phosphate glasses, and by 1933 it had been found that boric oxide was the best fluxing agent, and oxides of the rare-earth elements, lanthanum and thorium, and of other elements, columbium, tantalum, tungsten, titanium, zirconium, and strontium, were used in portions up to 80 per cent by weight. In 1934 glasses had been made with a refractive index of 1·85 and a reciprocal relative dispersion of 43·0. The new rare-element borate glasses were extremely corrosive to all known pot refractories, and platinum pots were therefore used for their actual production. The first commercial glass was delivered in 1939 and, during the war of 1939-1945, 125,000 pounds of rare-element glass were produced, the yield of finished, usable glass being 95 per cent of the theoretical available in the batch. The new glasses were first used in lens design in 1934, and many lenses still contain the high-index glass. Later, unusual flint glasses were worked out in the laboratory, the most useful containing titanium oxide and sodium fluoride in addition to silica. All-fluoride glasses were designed having the characteristic low refractive index and extremely low dispersion of natural fluoride minerals.

In 1929, K. C. D. Hickman, who had come from the Imperial College of Science, and who had been working on photographic chemistry in the laboratories for a number of years, studied the use of high vacua in certain aspects of the manufacture of film, and this led to an investigation of the operation of condensation pumps and of the properties of high-boiling organic liquids having low vapour pressures. C. R. Burch had suggested the use of high-boiling oil instead of mercury in the pumps, and Hickman found that dibutyl phthalate and, later, dioctyl phthalate, were suitable. Difficulties with the decomposition of the organic compounds led to the design of multi-stage fractionating pumps in which the fluid was continuously rectified and maintained in a condition of high purity. This gave much improved high-vacuum pumps. Use of these pumps for determining vapour pressures turned Hickman's attention to the possibility of fractionating substances by distillation in high vacuum and to the design of molecular stills. Special stills were applied to the distillation of a number of oils, in particular, fish liver oils, in which case it was found that vitamin A could be very considerably concentrated. On the basis of this work a company named Distillation Products Incorporated was organized to exploit the production of vitamin concentrates, particularly vitamins A and E, by molecular distillation. An important improvement in manufacture resulted from Hickman's invention of centrifugal molecular stills. Distillation Products Inc. (now Distillation Products Industries) later manufactured monoglycerides and other oil and fat products in addition to vitamins.

Until recent years, the most suitable substance known for slow-burning film base was cellulose acetate, and the laboratory co-operated with the manufacturing departments in research on the production of cellulose acetate and cellulose acetate derivatives, originally for film base but later for the production of textile yarn and moulding products. In 1937, a special research unit was started to work in this field, which had become the province of the Tennessee Eastman Corporation, and among the important developments were a method of making crêpe acetate fabrics and a large number of dyes for cellulose acetate. Study of the reaction between oxides of nitrogen and cellulose, particularly under W. O. Kenyon in Mees's laboratory, showed that polyanhydroglucoronic acid was formed. Such oxidized cellulose is sold to the pharmaceutical industry for soluble dressings and sponges used in surgery.

Mees frequently announced the most important results of the work of his laboratory by giving special and sometimes popular lectures on the subjects. He was much in demand as a speaker. He was proud of the work and of its contribution to the science of photography, and he recognized its public relations value. He felt that publication of much of the work would enlarge the knowledge of the basis of the subject, and even though it might help his competitors in business the resulting advance in the field as a whole could not fail to benefit his Company and science. A large part of the scientific work was published in the scientific, technical, and photographic journals as "Communications." They numbered over two thousand at the time Mees died. Starting with Communication No. 1, in 1913, he published biennial and later annual volumes of shortened versions of the papers as *Abridged Scientific Publications,* intended to concentrate the material in a form not requiring availability to the reader of a wide range of journals. In 1915 he began publication of a *Monthly Abstract Bulletin* covering the photographic and related literature. In the twenties he published a series of six *Monographs on the theory of photography.* Many of his staff have written books. Mees started a research library in 1912 which developed into the most complete photographic library in existence, and now contains over 30,000 volumes and over 450 periodicals.

The research laboratory has been expanded a number of times. In addition to the original building of 1912-1913, a larger and completely new building was erected in 1931 and this was greatly enlarged in 1937 and 1951. The rapidly increasing demands on space for expanding personnel showed that this could not accommodate the requirements for very long, and a new research centre was planned consisting of a group of separate buildings each devoted to a main field of the work. When Mees died, the first building, devoted to physics, was under construction. It was occupied early in 1961. When Mees retired in 1955 the staff numbered 734, and at the present time (June 1961) it counts well over one thousand.

The Eastman Kodak Company has manufacturing plants in several countries, and laboratories were also established at some of them to do research in the science and technology of photography. The English laboratory was established at Harrow in 1928, the first director being Walter Clark (who later went to Rochester, when his place was taken by E. R. Davies); the French laboratory at Vincennes was organized in 1928, the director being Marcel Abribat; there is a laboratory at Abbotsford, Victoria, Australia, under N. B. Lewis; and, in 1946, a tropical research laboratory was started in Panama under C. C. Soper. Other research laboratories of the Company deal with chemical problems. That of the Tennessee Eastman Division at Kingsport, Tennessee, is concerned with plastics, fibres, and chemicals; that of the Texas Eastman Division in Longview, Texas, with large-scale synthesis of petrochemicals; and that of the Distillation Products Industries Division with vitamins and high-vacuum distillation, especially of fats. All of these laboratories stem from Eastman's early interest in research and his selection of Mees to develop it.

Basically, Mees was a pioneer, energetic, aggressive, and a great and authoritative talker. To some he appeared rather rude but this was partly a form of brusque impatience over intellectual laziness or sloth in others. He always rose to a verbal challenge and could be a devastating opponent in debate. He wanted facts, knew their significance, could sort them out, and spoke with great clarity. He rarely admitted defeat, but was ready to adjust his thinking to the new idea.

Mees recognized the significance of the individual and brought into his sphere as many as he could, and protected them from outside interference. He had an unquestioned talent for keeping his men stimulated. He had vision and forcefulness and ability to encourage others which led to much of the great progress in photography in this century. He was one of the rare and reassuring people who recognize and encourage genius, leave it alone to blossom, and then steer its product to a worth-while end.

In his book, *Industrial explorers*, Maurice Holland said that Mees was "earnest in his search for truth and knowledge. He had no use for charlatans, and woe betide the individual with spurious facts who tries to put them over. On such occasions, Mees uses facts as a soldier uses hand grenades, and the result is as devastating." Once in a while, however, he would express himself with conviction but error on subjects with which he was not too well acquainted. The writer remembers occasions early in the war of 1939-1945 when Mees had daily discussions about allied strategy with his friend Colonel O. N. Solbert, a West Pointer, retired. He was invariably wrong. One of the most glaring instances of his being wrong was when he maintained that the German occupation of Norway was one of their great mistakes, because it would undoubtedly lead to their undoing at the merciless hands of the British fleet. He was, however, deeply concerned with the fate of Britain early in the war, and he was moved to tears in contemplation of the possibility of a German invasion of the British Isles.

Mees had always been an avid and lightning reader, and it was fascinating to see him skim a page and hurl the essence of it at his listener who had scarcely got beyond the first line. He had a very extensive library and loved printing as a means of communication. He was well read in Egyptian archaeology and well versed, partly by reading and partly by experience, in astronomy and marine biology. Late in his career he went whole-heartedly into a programme for doing low-cost, short-run colour printing, primarily to enable scientists to illustrate their articles in colour—a thing which they could not afford to do adequately by the normal methods. He also worked hard to get the printing industry in the United States to inaugurate a co-operative research programme, but with little success.

Mees himself wrote about 250 articles, most of them in the form of scientific papers, and a number of important books. In 1942, he made his greatest contribution to scientific literature with the publication of *The theory of the photographic process*—"a fat and heavy book"—written with the aid of his associates. In it was brought together the state of knowledge of the theory of photography, and it was intended to form a comprehensive survey having the object of stimulating work on photographic theory. A second edition was published 12 years later, entirely rewritten, and with about one-third of its contents changed. He hoped that members of the research laboratory which he founded would put out revised editions from time to time with the same objective.

Mees's accomplishments have been recognized by a great array of honorary degrees, invited lectures, and honours and awards given him by a great number of societies and organizations in many countries. His greatest recognition was the award of the Fellowship of the Royal Society in 1939. He was also made a Fellow of the American Philosophical Society in 1937, and a member of the National Academy of Sciences in 1950. An honour of which he was particularly proud was the award in 1913 of the Progress Medal of the Royal Photographic Society, the highest honour in photography, for "his researches, discoveries, and publications in the physics and chemistry of photography." He received the same award again, and for the same reasons, in 1953 (Sir W. de W. Abney was the only other recipient of the Progress Medal on two occasions). He was the only non-astronomer to receive the Henry Draper Medal. In 1954, he received the gold Franklin Medal of the Franklin Institute. He was the Children's Christmas Lecturer at the Royal Institution in 1935 on "Photography," and the Children's Christmas Lecturer for Young People at the Franklin Institute in 1941, on "Colour photography."

Mees admitted that he was never particularly interested in outdoor sports, although he played some golf, but even this had to be dropped when he had a leg amputated when he was about 70 years old, a matter which he endured with typical fortitude. In this connexion, on 21 May 1951, he wrote a letter: "To my friends: I was quite unexpectedly stricken with a serious illness, and I thought I would like to write to all of you and tell you what has happened to me, what I am hoping to do now, and especially how much I appreciate your loving kindness." He then related how on 29 April, returning to Rochester after giving the Haynes Foundation lectures at the California Institute of Technology and from the National Academy meeting in Washington, he suddenly developed a complete block of the larger artery, leaving the left leg bloodless. Ten days later they took off the leg. "The prognosis is quite good. I shall be able to use an artificial leg and shall be handicapped very little. I owe everything at the moment, of course, to the skill of the doctors and the surgeon." It was quite evident to his friends, however, that the loss of his leg inconvenienced him more than was evident from his general bearing, although he did continue to drive his car, and appeared to evince his early spirit. His greatest personal loss occurred with the death in 1954 of Mrs. Mees, with whom he had lived a close and devoted life since their marriage.

Mees had retired as active director of research for the Eastman Kodak Company in 1947, but he continued as Vice President in charge of research for eight more years, finally retiring in 1955. He died in Hawaii on 15 August 1960, at the age of 78.

In earlier years, Mees had spent a lot of time in Bermuda, but in later years he transferred his travels to Hawaii, where he had family ties, and he retired to these Pacific islands in 1955. After going there, he did not return to the United States, but devoted himself to many local interests. He retained his interest in astronomy and had a big telescope, and also resumed the interest in marine biology he had fostered in Bermuda. He cultivated orchids, lectured at the university and schools there, wrote the major part of the manuscript of a book on the story of Kodak photographic research, and, at his death, was working on an autobiography. He had a constant parade of visitors with whom he could talk in his old, enthusiastic way, and received correspondence from all over the world. It is said that he lived an idyllic life, in a peaceful spot overlooking the Pacific Ocean. He had a batman, a cook, and his secretary who lived nearby and who had been with him a great many years in Rochester. He kept himself busy, yet it is felt that he was not particularly happy, especially with the loss of his wife and his physical handicap.

Mees married Alice Crisp on 1 June 1909, at Croydon. Her father was Isaac Crisp, a reader for Longman's, Green and Co., and her mother was Catherine Elizabeth Watkins. Mees is survived by his two children—Graham Charles, born 11 July 1910, and living in Rochester, New York, and Doris Margaret, born 22 May 1912, now Mrs. Rohan S. Sturdy, and living in England.

C. E. K. Mees had led a full life and left a lasting impression as a result of his astonishing breadth of knowledge, his kindliness, his deeply human qualities, his forceful personality, and his extraordinary command of the language and power of expression.

L. A. Jones, one of Mees's associates for the greater part of the time he was in the research laboratories, said of him: "While he has been successful as an individual research worker, his great success and his great contribution lie in the ability and sagacity he has shown as director. His unbounded enthusiasm, his vivid imagination, and his uncanny ability to suggest the most fruitful experiments to perform have been a constant source of inspiration and encouragement to the members of his staff. His pre-eminent fairness to those working under him, his kindliness, and his humanity have endeared him to the hearts of his associates.

WALTER CLARK

Diary of a Visit To Orringh Stone in 1803

BY JAMES STONE

One of the most interesting early accounts of Brighton and the surrounding Monroe County area is the James Stone diary of a trip to that area in the late Summer and early Fall of 1803.

James Stone was then 20 years of age and a senior at Williams College. He was a son of Capt. Enos Stone of Lenox, Mass., and a brother of Orringh or Orange Stone, builder of the wilderness tavern which still stands today in East Ave., Brighton, just west of Clover St., and is known as the Stone-Tolan House.

Despite the fine romantic rapture with which young Stone describes some of the beauties of the area, his account tells us much about life in what then was the Town of Northfield.

The diary later came into the hands of the late A. Emerson Babcock, former Brighton supervisor and longtime student of the area. The version which we print is taken from a transcription he made in 1943 of the original manuscript.

On the twenty ninth day of August in the year of our Lord, one thousand eight hundred and three, I set out in company with my Father on a journey to the westward intending to go as far as the Genesee River; then down the river to Lake Ontario and across the lake into Niagara. We travelled the day in which we began our journey from Lenox through a corner of Richmond into New Lebanon where we made a short stop; from New Lebanon we went as far as Stevenstown and then from the before mentioned town we travelled as far as Shaden on the turnpike and took refreshments. From there to the North River which we crossed at Albany and put up at Albany at Mr. Crane's Inn. At evening I fell in company with one of my former classmates, and after supper we walked over the greater part of the town of Albany and spent the evening in agreeable conversation and drinking wine and beer. I returned after the evening was spent to the Inn and went to bed.

August 30th. The morning of the day was clear and pleasant and we proceeded from Albany through what I called the "Devil's Kitchen." The day being warm, the Devil was lazy, and besides the dust so completely filled these lowe valleys, which are naturally very gloomy, that we could not see, and we made our escape after much fatigue into Derousberg and called to a tavern where they kept neither bread or meat, grain or hay, and we travelled 16 miles before we could get any breakfast. The land for this distance was entirely parched with the drouth and apparently very barren. After breakfast we travelled through Schoharie and Sharon and put up within six miles of Cherry Valley.

3rd day August 31st. This morning was likewise fair and pleasant and we continued our journey very early through Cherry Valley and on through Cooperstown, the country town which lies on the south end of the lake and here we made a short tarry and took refreshments. From Cooperstown we travelled on the turnpike road about twelve miles and then left the turnpike and took our course S. W. through what is called the "Butternuts," nearly ten miles, and then we tarried during the night.

4th day Sept. 1st. The weather this morning was similar to the preceding. Uncommonly clear and pleasant. Nothing presented itself on the day worthy of notice. Except the roughness of the country over which we travelled. We made about 47 miles this day. At sunset we put up at an Inn at Severy and I slept for the first time in a log cabin house.

5th day Sept. 2nd. This morning we rode 9 miles before breakfast to General Patterson's where we spent the day and the day following. The situation of this place was agreeable beyond description. It was truly romantic and captivating. The house stands on a high bank at the foot of which runs . . . which is formed by the conjunction of two beautiful streams about 20 miles north of his house. To the south the river flows on smooth and uninterrupted. On the west lies a tract of wood land and continues North on the bank of the river. Here we spent two days and it is natural to suppose that the time was agreeably passed over, when we consider the situation of the place, and the unexpected meeting of the General and my father. They were friends in early life and their mutual toils and hardships through the American Revolution tied a double knot in the silken cord which time nor subsequent individual misfortune could ever unloose nor the shafts of Merciless calumnators render asunder. Nor could the slowness of time make them weary of their friendly engagements, nor absence create anything but a desire of meeting,

Oh here swam they both on Fortune's tide
Where each in silent woe saw each
Overwhelmed in boundless Night, and thought
Of naught but mutual sympathy.
At length broke forth the joyful day
Which saw them both in hoary locks
Join hands and swell with briny tears
The peaceful sea on which they swam
Which ebbs and flows prosperity.

5th day Sept. 4th-5th, and 6th, we spent in visiting our old friends and relations. On the Sabbath we attended Meeting and had the pleasure of hearing Mr. Willison preach.

September 6th. On the morning of this day we set out for the Genesee, and arrived at my brother's (Orringh Stone) in Northfield, Ontario County, a little after sunset on the 9th. I was unable to keep my journal on account of illness from the 6th to the 9th. After the usual compliments and salutations were passed on both sides we ate supper and soon retired to rest.

Sept. 10th. In the morning I went a hunting filled with an idea that it would afford me much satisfaction and that it would be an easy matter to kill a deer, but to my extreme mortification and contrary to my boasting I was forever to return without anything. In the forenoon we went to Gerundegut Landing. (A broad road ran from Orringh Stone's directly to the Indian Landing.) In the afternoon we went to Mr. Walker's on a visit and I returned home at night, unwell, and retired to bed. (Mr. Otis Walker lived on the opposite side of Clover Street. Next house north from my house. [*i.e.* the then Babcock house, now owned by Edward Harris, Jr.] This house was destroyed by fire a few years ago. In this house when Romanta Hart lived there, the late Mr. James Hart of the W. S. Kimball Co., and later a member of the American Tobacco County, was born.)

Sept. 11th. This morning I went out with my father with an idea of seeing the country and to have a prospect of the falls. On our way to the falls we passed some of the most beautiful scenery that ever covered the face of the earth. The situation and the apparent fertility of the soil together with the general appearance of the country as far as the eye reached would fill the mind with a romantic delight, and at the same time the grandeur of the prospect moved the mind with wearing satiety. I walked among the woods where the trees moved their high heads beautifully majestic among the still dispersed clouds, catching with their green boughs the wandering breeze as it strayed fitfully over the beautiful Paradise. I travelled until I came to a gentle rise of land and after I had come to the top of it, I sat myself down very much fatigued, and I say without any duplicity that I had from this apparently small rise of ground (probably Cobb's hill) the most complete, the most enchanting prospect the Nature ever completed, or imagination invented. The land descended with a gentle descent on my left toward the river, but the river itself was secured from the eye by the height of the woods. From this site the prospect is unbounded. On the right the ascent is small for a short distance. Then it descends again slow and regular without the least sensible variation until it reaches the banks of the Irondequoit. Thence proceeding in an easterly direction, broken with small regular hills it extends beyond the reach of the bodily eye, almost outreached the flight of the mortal eye. Again south is a small hill in the form of a cone (The Pinnacle). Here we have only to raise a few paces, and the most beautiful, the most romantic and sublime prospect presents itself which nature in the full exertion of its strength could form. You stand on this small rise of land and Nature presents its scenery as far and whithersoever the mortal of the bodily eye directs itself. To the south and southeast uncultivated parts of the land where the trees with their thickest boughs form a wide extensive plain before you. Almost as far as the eye in its vigor can extend itself it discovers nothing but this unbounded level formed by the tops of the trees. After the natural dimness is removed from your eye and the sun shines in its Meridian splendor, you faintly discover at an immense distance through the blue haze of the Allegheny Mountains. But on each side of the ridge the prospect is without boundary. Here the mind elate with the impressions already made upon it and impatient of restrained turns partly from the prospect on the south and calls on the eye to seek new work and remove all obstructions from the fleight of the imaginations. The eye eager to obey the mandates of the mind quick travelling round the eastern horizen discovers in the north as far as it can, extend no boundary but its own insufficiency and no impediment to oppose its progress, but the blue misty shade of light which vanishes at the near approach of the eye and only does insult without emotion the impatient eye while sitting on the brow of Infinity. Now the eye once satisfied calls the imagination to feed itself for what it can discover. Before you is beauty, grandeur, and sublimity. First before the eye can extend itself you are saluted by distant roaring of water and the eye flies about to discover the cause. It discovers a vast plain formed by the thick cluster of tree tops, but still the cause of the sound after which it was in search of remains undiscovered. It extends itself with quick accurateness and is immediately met by the foaming waves of Ontario. Fearless it continues riding backward and forwards on the trembling surges wandering further and further until it is lost beyond the waves and returns dim and almost senseless. The imagination flags, frantic with joy on the smooth tree tops, and flying over the distance breaking waves feeds on dainties beyond its capacity to digest, till satiated with the sport and around with astonishment and wonder it is borne home in the career of unconscious pleasure.

September 12th. I went with my father to Stone's Town (Pittsford) a visiting and spent a day at G. Perrin's principally. However, I had an opportunity to view some parts of that township of land. It is not in my opinion far inferior in quality to the town North of it. It is in general more uneven and stony. However, there are some excellent farms.

Sept. 13th. This day was the Sabbath and consequently spent in idleness, but I was not idle without some reason, and perhaps this idleness was sufficient to justify me. In this town they have no Meeting House, nor is that all; they have no meeting except occasionally when some poor straggling illiterate Methodist wanders from the road and is obliged to preach, for his meat and his drink, and it so happened this day no Methodist got lost.

Sept. 14th. Early this morning my father and I went through the woods to Red Creek on horseback which runs at the southwest corner to Northfield, and empties into the Genesee River. From Red Creek we went down on the banks of the Genesee River to the big falls and then returned on our way home. On my return I had the satisfaction of killing a rattlesnake.

Sept. 15th. This day was spent partly in visiting and partly in hunting. In the morning we visited Mr. Spafford's where we ate excellent Genesee Watermelons. In the afternoon we went a hunting, but our hunting was like the hunting for a deer when there was no such thing.

Sept. 16th. I went alone hunting to no effect. When I returned home I found that my brother had lost three sheep, which he supposed to have been killed by wolves. My father and I went a hunting bees and in this fortune proved to be very kind. Toward evening we went in search after the lost sheep and found them dead.

Sept. 17th. The forenoon of this day was wet and lowry and passed over accordingly. In the . . . I went on feats of gallantry and had much better fortune in hunting Does alone than Bucks and Does together.

(Latin quotations here)

Sept. 18th. Early this morning we went in search of the wolves, which had committed the mischief two days before, and found that one of them had stolen a Trap which was placed on the carcass of one of the dead sheep. We at once became honest and well disposed citizens. Pursued the thief with three good dogs, and had the good fortune to overtake him. The forward dog gave the summons in very few words and then proceeded to take him prisoner. The other dogs came to his assistance and dragged him before a Court of Inquiry, when he was found guilty of wilful murder and sentenced to be put to death. Wherefore and in pursuance of this decree the dogs were commandered to be the executioners and immediately put their order in execution. The remainder of the day was spent in visiting.

Sept. 19th. This day was the Sabbath, and I to my extreme mortification was not at home. Where was I then? I was waiting in the Ante Chamber of Pleasure where I expected every moment to behold my destiny clothed in all the beauty of the morning, with a . . . I expected to perform extraordinary feats of gallantry, but Alas! my days of chivalry are over at 20, and the flower of my achievement fades like the tall Lilly when it is exposed severed from its stalk to the scorching suns beam at noons day, and my glory like the dew drops of bliss the morning sun fades and vanishes before the coming glory of my successors. However I took the task allotted to me with pleasure and I performed to the general acceptance of all who had the satisfaction of being present and this also satisfied myself and one other. I returned home in the afternoon, and brought somebody home with me. Thus closed the Sabbath and the morning of the next day was the twentieth.

Sept. 20th. We spent the day in scouring the road and taking news of the land. At evening I had the fortune to kill a Racoon and returned happy with my success.

September 21st. Three of us in company went in a skiff to the Broad Bay (Irondequoit Bay) intending to take a view of the Bay and sport among the ducks and geese. We had one shot at a flock of ducks and killed four in imagination, but in reality . . . We intended to have staid over night, but the wind rose and brought on a storm and we gave over the idea. We set out for home while it was raining, but before we got home it rained severely, and we stopped at the Landing, took a little of one thing needful—8 ozs. of spirits and we were prepared to beat against the wind and weather and storm until we got home.

Sept. 22nd. This morning was fair and pleasant and we regretted that we had not stayed at the Bay over night. In the forenoon we went to gathering grapes, and picked as many as three of us could carry home, and I presume without any exaggeration that there were . . . and . . . which of us. (Original manuscripts lost and these gaps cannot be accounted for) light to witness the severity of the approaching morning and satiate ourselves on the wild beauties of Nature. After refreshing ourselves with a little food, we again embarked aboard our skiff and rowed down the Bay to the Lake. Here we encamped and killed a number of fowls. Some of which were of a kind I never saw before. My father and brother went into the woods a hunting, but I was so captivated by the prospect that I chose to remain by the Lake. About 9 o'clock at night I strayed alone on the Lake Shore and amused myself with the beauties which the pleasantness of the night presented me. The moon was full and nothing to obstruct its rays, which were attracted by the beauties of the lake. The clouds had lain themselves to rest behind the purple horizon, and the winds flew without control over the troubled waters. In this situation at such a wide distance from my native home, and moved by the grandeur of what lay before me, I enjoyed uninterrupted reflections which filled the mind and swelled the heart like the distant vibrating echoes that roll from the Harp when touched by Angelic hand. When I returned to the camp I found my father and brother had returned laden with beasts they had caught the preceeding afternoon. They had killed a Bear, a Deer, and a Racoon. We cooked a supper of ducks and fish which I caught in the afternoon and layed down to rest. The Earth was our bed, a blanket all our covering and Nature hung over us a beautiful blue sky with sparkling stars and a silver moon which moved slowly over our heads and drawn by the finger of God. The roaring of water and the shrieking of owls mingled with the silence of the night formed a sweet music which lulled us to sleep.

September 29th. Again we woke this morning agreeably refreshed and discovered the Lake almost entirely smoothed and unruffled. After refreshing ourselves we made preparations for hunting, and killed a Porcupine, and we loaded ourselves and returned home elate with our success.

Sept. 30th. Nothing is more pleasant at the same time more useful than reflection. To survey and replace on the works of Art affords a degree of satisfaction rarely anticipated by any but those who can devote a few moments at least to serious reflection. To reflect on the works of Art not only difuses into the mind a sweet inexpressible, but points one to us the preeminence and dignity of man. It brings into view the rationality of ourselves, the austereness, the - - - and unbounded scope of the mind and discovers the agility and almost unconquerable strength of understanding. But to view the works of Nature and Art and elevated above its natural place it rides on the borders of immensity and withers, and wheels in the path of unknown worlds. The dignity of human nature before us, and the soul conscious of its immortality, vibrates alternately between hope and fear, yet flutters to break loose and fly thro the thick mist which surrounded it. So elevated is man, so exquisite is his enjoyment wherever sounded forth the beauties and productions of the sports of Nature when he is lost in a labyrinth of thought in contemplating the skill, the wisdom and the power of the Great Architect of Nature, that he almost forgets his accountability and is willing to pass into Eternity and purchase an universal prospect of Nature at the price and risk of that which he never delays? (But these are some grave thoughts. Perhaps should be credited to Addison W. T. S.)

Such were the thoughts that crowded into my mind while I was overlooking a boundless tract of uncultivated land and listening to the roaring water which fell from a precipice concealed in the distant woods. I arose from my seat, and resolved to visit the falls, where I might view that stupendous mound which Nature gave the Earth at Creation, without any molestation. But when I returned home I found it would be impossible to be alone, for there were a number of ladies anxiously awaiting my return to accompany them to the falls. However I was resolved to encroach upon the laws of gallantry rather than destroy the plan I had in contemplation and not-with-standing the mirth and hilarity of my Company. I made all the observations in my power. My uncommon steadiness was soon observed and my company caught the distemper which lasted until they reached home.

Copied by A. Emerson Babcock for
Miss Mary Moulthrop.
March 12th, 1943.