In this disease, it is too much to hope to find a means of destroying the cancer cell alone, without the destruction of surrounding or accompanying normal cells. The so-called cancer cell offers too little difference from normal cells to expect that there should be a chemical specificity in the cancer cell which distinguishes it to such a degree from normal cells as to make it possible to attack the cancer cell alone. But it is not too much to hope that cancer cells can be restrained from division and, if this is done, the cancer cell will lose the quality which characterizes it—its power of spreading in the tissue which depends upon multiplication by division. The form of the cell is a function of time and if division can be slowed the cancer cell loses its characteristics. Like weeds in a field, if the cells can be made to cease to grow and multiply, they will not spread, even if they are not destroyed.

In this study of the environment, or blood plasma, Reding, of the Cancer Center at Brussels, has found that cancer is generally associated with a more alkaline pH[2] and with a diminution in the ionized calcium and even total calcium in the blood plasma. In other words, in cancer, a disease which is dependent upon cell multiplication, are found conditions which favor such multiplication in single-celled marine organisms. In addition, after X-rays or radium treatment, which is one of the most effective means of treatment, Reding finds there is a shift in pH (when the treatment is clinically effective) towards the relatively acid side of normal and the ionized calcium is increased in amount. In other words, the treatment which is effective in controlling cancer produces conditions similar to those in which cell division is hindered in single-celled organisms.

To the cancer research worker, these findings, if confirmed by others, will be most illuminating. They will show that it is possible to control cell division in the body by environmental changes and open up new fields in the attempt to control such cell division by the aid of chemical substances and by the alteration of equilibrium. Any cell with a definite physico-chemical organization will follow a constant course of transformation if external conditions are constant, but, if these are changed, the course of transformation will also be altered. These findings, too, will give a means of biological control of the present most effective treatment of inoperable cancer, the radiation from X-rays and radium, where there are now only the rough criteria of the clinical aspects of the tumor.

And last, but by no means least important, is the finding that the physical forces of radiation by X-rays and radium produce measurable chemical changes in the blood plasma, or the physico-chemical environment of the vital system. This fact is most intriguing in that it leads to the hope that by chemical alterations in the blood it may be possible to produce effects similar to radiation, or to extend the effects of radiation by chemical means. In the moving pictures to-night you will see the effect of radiation upon cells and cell division and the sudden cessation of activity as a result of radiation. The mechanism of these effects has been thought to be upon the nucleus and chromosomes, as has been shown by Muller in his mutation experiments, but there seems to be another effect which influences the environment, and it may be that this is an effect upon the cell membrane. It may be that by altering the environment of the cell, the blood plasma, that such membrane effects may be obtained as an aid or substitution to radiation in preventing cell division.

So you see that in these problems the chemists are our hope, but it is our duty to state the problem of cancer to them in such terms as to explain the mechanism of action of the cells and in this way get the full value of their advice. The unit of life is the cell and the cell is colloid in character. Substances which may have a hope of benefiting the disease will be those which restrain cell division without complete destruction of cell function and those which will permit the cell to mature from its embryonic condition to that state where the inhibitions or restraint of the growth gradients are once more effective. Cancer is a disease of age and this is a time when cell division should be limited.

If this restraint of division can be obtained or if the influence of radiation can be extended, the hope of benefit in this disease shines brightly. In this we are gratefully in the hands of our friends, the chemists, and it is to them that we wish to state our problem in its mechanism, so that there may be an intelligent viewpoint for them to apply the knowledge which is theirs.

ELLICE MCDONALD
PHILADELPHIA, PA.

[2] The work of Reding and some studies by ourselves will be published in book form under the title, "Blood Studies in Cancer," Williams and Wilkins Company, Baltimore. There will also be included a description of a new electrical pH measure and some description of the method of its use with the quinhydrone electrode. The importance of pH in the study of cancer has led the Cancer Research Committee of the Graduate School of Medicine of the University of Pennsylvania to work on the improvement and exactitude of pH measurements.

JOHN MERLE COULTER

IN the recent death of John Merle Coulter, professor emeritus of botany, of the University of Chicago, plant science has lost a profound student, an inspiring

teacher and a prominent leader. Professor Coulter was born of missionary parents at Ningpo, China, on November 20, 1851, and died at Yonkers, New York, on December 23, 1928. His father died in China in 1853, and his mother with her two sons, John and Stanley, returned to America a few months later to the home of her father, Dr. John F. Crowe, of Hanover, Indiana. Professor Coulter's boyhood was spent largely in Hanover, his early education being cared for in nearby private schools. Entering Hanover College, he was graduated with his A.B. degree in 1870 and from the same institution received his A.M. degree in 1873. From Indiana University he received the Ph.D. degree in 1882 and the LL.D. in 1920.

In 1870 he went to Logansport, Indiana, and taught Latin in the Presbyterian Academy there. He was professor of natural sciences at Hanover College from 1874 to 1879; professor of biology, Wabash College, Crawfordsville, Indiana, 1879 to 1891; president and professor of botany in Indiana University, Bloomington, Indiana, 1891 to 1893; president of Lake Forest University, Lake Forest, Illinois, 1893 to 1896; professor and head of the department of botany in the University of Chicago, 1896 to 1925, and scientific adviser to the Boyce Thompson Institute for Plant Research, Yonkers, New York, 1925 to 1928. He was largely responsible for the foundation of the Boyce Thompson Institute for Plant Research, and was a member of its board of directors from its foundation until the time of his death.

At the request of the board of trustees he retained his position as head of the department of botany at the University of Chicago for three years after he reached the retiring age of seventy.

At the age of seventy-two he was granted, by the board of trustees, a leave of absence to visit and lecture in China and Japan. This journey, on which he was accompanied by Mrs. Coulter, was arranged by a government organization known as the National Association for the Advancement of Education. On this journey he visited all the principal universities and colleges in both countries, and delivered more than two hundred lectures and addresses besides attending numerous receptions and banquets. The object of the visit was to promote friendly and understanding relations between the educational institutions of America and those of the Orient.

Although he early showed an interest in geology and natural history, his botanical work really began in 1872 when he became a junior member of the Hayden Survey of the Territories. Joining the party as assistant geologist, he was soon appointed the official botanist of the expedition on account of his interests shown in collecting plants during the stay of the party at their western base of supplies. He was therefore a member of the first group of scientists to visit what is now Yellowstone Park, to begin the study of its geysers and to collect specimens of its flora. While studying these collections at Washington, preparatory to writing the report of the botanist of the Hayden expedition, he came in contact with Asa Gray, and this acquaintance ripened into a lifelong friendship. Coulter soon became Gray's most brilliant pupil. This close contact with Gray eventually culminated in the production of the sixth edition of Gray's "Manual of Botany," revised by Coulter and Watson.

Following in the footsteps of his great teacher, Coulter issued in 1885 his "Manual of the Botany of the Rocky Mountain Region," that became when revised by Nelson in 1909 the "New Manual of Botany of the Central Rocky Mountains." In 1892–93 this was followed by the "Manual of Texan Botany."

In close sympathy with the teaching of plant science in secondary schools, Professor Coulter wrote in the following years a series of elementary text-books which included "Plant Relations" in 1901, "Plant Structures" in 1904, "Plant Studies" in 1904, "A Text-book of Botany" in 1906, "Fundamentals of Plant Breeding" in 1914, "The Evolution of Sex in Plants" in 1914, "Evolution, Heredity and Eugenics" in 1916 and "Plant Genetics" in 1918.

Professor Coulter founded the *Botanical Gazette* in 1875, and for fifty years was its editor. This journal, which he not only edited but in its early days managed and financed, soon became the leading botanical publication in America, and has long been recognized in every country as one of the best organs for the publication of the results of botanical investigation. In it there early appeared a series of articles on the Umbelliferae by Coulter and Rose that finally took the form of a "Monograph of North American Umbelliferae" by John M. Coulter and J. N. Rose, appearing as Contribution U. S. Herbarium 7 (256 pp., 65 figs., 1900). Soon afterwards the appearance of "Preliminary Revision of North American Species of Cactus, Anhalonium and Lophophora" and "Preliminary Revision of North American Species of Echinocactus, Cereus and Opuntia," Contribution U. S. Nat. Herb. 3 (91–132, 355–462, 1894, 1896), by Coulter himself seems to indicate that his primary interests still lay in taxonomy.

The acceptance of the position as head of the department of botany in the newly organized University of Chicago, in 1896, seemed to mark the beginning of a period in his life dominated by a major interest in plant morphology. Soon a series of "Contributions from the Hull Botanical Laboratory," largely morpho-

logical and the results of the researches of Coulter and his students, began to appear in the *Botanical Gazette*. This series reached its 388th number in the December, 1928, issue of the *Gazette*. The advances in plant morphology to which this series contributed so largely were summarized in two of Coulter's most important books, written in collaboration with one of his most distinguished pupils, C. J. Chamberlain, now as then a professor in the department of botany at Chicago. These are "Morphology of Angiosperms" (348 pp., 113 figs., New York, 1903) and "Morphology of Gymnosperms" (458 pp., 462 figs., Chicago, 1910). These were followed by a "Text-book of Botany" (for colleges) to which Coulter contributed the section on morphology.

As a teacher Professor Coulter excelled. His clearness of presentation, his wide perspective, his keen sense of proportion, his remarkable powers of generalization and his kindly, fatherly interest in all his students made him an ideal guide for young scientists. No other botanist in America attracted so many students to his classes and no one was more successful in inspiring each student to excel in the field of his particular interest. His great versatility is seen in the fact that although he was originally a taxonomist and later a morphologist, his students excelled not only in those fields but also in plant physiology, plant ecology, paleobotany and phytopathology. More than 175 students were graduated with the doctor's degree from the department over which he presided for more than a quarter of a century. Many of these have won the highest botanical positions in the United States, Canada, China, Japan, India, Australia and Great Britain. Perhaps his most unique achievement in this respect was to build up a large department at the University of Chicago, a department in which the principal branches of plant science were represented by specialists, entirely from the personnel of his own students.

Professor Coulter was a profoundly religious man. For twenty-nine years he taught a large men's class in the Sunday School of the Hyde Park Presbyterian Church and occasionally occupied the pulpit of the same church. His was also an influential voice in the councils of the local church and in those of the larger organization of which it was a part. He could see no conflict between the truths of religion and those of science. When the teachings of theology conflicted with those of science he revised his theology but kept his religion.

Some of his religious views have been expressed in such articles as: "The Religion of a Scientist,"[1] "What Biology has Contributed to Religion,"[2] "Jesus' Attitude towards a New Religious Movement,"[3] "The Attitude of Jesus Towards Religion,"[4] and "Where Evolution and Religion Meet" (in collaboration with his son, Merle C. Coulter) (105 pp., 1924).

He was an attractive and inspiring speaker and was much in demand for commencement and convocation addresses. Twice he was convocation orator at the University of Chicago.

His membership in scientific societies seems to have begun with that in the Indiana Academy of Science, of which he was president in 1886. A fellow of the American Association for the Advancement of Science, he was elected its president in 1918. For years a member of the Botanical Society of America, he was its president in 1897 and again in 1915. He presided over the American Association of University Professors in 1918, over the Illinois State Academy of Science in 1910 and over the Chicago Academy of Science from 1916 to 1924. He was a member of the National Academy of Sciences, the American Society of Naturalists, the Washington Academy of Science and of many foreign botanical organizations.

In 1874 Professor Coulter married Georgia M. Gaylord, of Delphi, Indiana, who survives him. Six children were the result of this marriage. A son and a daughter died in childhood, while two sons and two daughters are still living. They are John Gaylord, of Paris, France; Grace A., of Chicago, Illinois; Margaret (Mrs. Edward R. Yarnell), of Easton, Pennsylvania, and Merle Crowe, of Chicago, Illinois. Both daughters were graduated from the University of Chicago and both sons received the Ph.D. degree from the department presided over by their father. Merle C. is now associate professor of plant genetics in the same department.

At the celebration of the quarter-centennial of the University of Chicago, in June, 1916, the doctors in botany, then numbering eighty, gave Professor Coulter a presentation volume containing a record of all doctors graduated from the department up to that time.

On December 27, 1928, there was founded a John M. Coulter Research Fellowship at the University of Chicago by presenting the university with pledges amounting to more than $25,000. This sum had been subscribed by 130 doctors and 75 alumni and past students of the department of botany. This fellowship, for which only the interest of the fund will be used, is to carry forward the work in which Professor Coulter was so vitally interested. It will be tenable at the University of Chicago in any branch of plant science and will be granted to candidates for the doctor's degree who have research well under way. Such fellows will devote at least one half of their time

[1] *Biblical World*, 41: 80–85, 1913.
[2] *Ibid.*, 41: 219–223, 1913.
[3] *Homiletic Rev.*, 67: 175–177, 1914.
[4] *Ibid.*, 70: 183–185, 1915.

to research, will be exempt from tuition fees and will have no service or teaching duties. It seems fitting that the first nomination to the Coulter Fellowship is to be made within a very few months of the death of the great teacher whose memory it perpetuates.

Another movement to honor Professor Coulter culminated on the evening of December 28, 1928, when the president of the Botanical Society of America, Professor A. H. R. Buller, presented to Mrs. Coulter a memorial volume containing the names and the appreciative letters of hundreds of Professor Coulter's botanical friends. The volume was accompanied by a silver tea service. The gifts were received by Dr. Wm. Crocker, acting on behalf of Mrs. Coulter.

While all regret that Professor Coulter did not live to see the culmination of these efforts to do him honor, it is some satisfaction to remember that he was aware of the completion of the John M. Coulter Research Fellowship Fund and of the compilation of the memorial volume by the members of the Botanical Society, and that he expressed his high appreciation of these tokens of affection coming from his pupils and his friends.

GEO. D. FULLER

THE UNIVERSITY OF CHICAGO

SCIENTIFIC EVENTS

BIOLOGICAL ABSTRACTS

THE following is a somewhat abbreviated statement of the points brought out in a report on the progress of *Biological Abstracts* presented to the council of the American Association at the fifth New York meeting, by Professor Herbert Osborn, representative of the association on the board of trustees of *Biological Abstracts*. The journal has been promoted by the Union of American Biological Societies and has received support from the Rockefeller Foundation, which has contributed $50,000 per annum to be available during a period of seven years. In addition, the project receives subscriptions from institutions and individuals, reported to have aggregated $41,860.37 for the period from July 1, 1926, to April 20, 1928. Ten issues have been published, Volume I being complete, except for the index, and Volume II started. The scope and complexity of this project are indicated by the following quotations from a statement recently made by the editor-in-chief, Dr. J. R. Schramm.

1. The literature is extremely widely scattered and consequently more difficult and costly to assemble than that of other fields, as evidenced by the fact that some 6,000 serials must be perused to make the journal fairly complete. (*Chemical Abstracts* at present abstracts from 1,250 periodicals.)

2. No other science begins to present the complex indexing problem presented by biology, largely because of the enormous extent of taxonomic literature. It now requires six persons, part scientifically trained and part clerical, to do the indexing of systematic botany and zoology alone, and this staff may require additional slight increase. It is generally conceded, however, that the indexing procedure in *Biological Abstracts* is limited to the necessary.

3. The subject is more diversified than that of any of the other major scientific fields, biology being to a larger degree the meeting ground of all the natural sciences. The central staff must necessarily be larger and more diversified in its training.

The editor-in-chief has made the following statements concerning the progress already made, in the light of the original plans and estimations. It was estimated that the literature to be abstracted would total about 40,000 titles annually and there is as yet no reason for modifying this estimate, though probably the number will eventually be larger. It was estimated that abstracts would be printed at the rate of twelve per page, of the format and typography finally adopted, and the average for Volume I is 11.3. The cost of printing the text was somewhat overestimated, but no statement can yet be made concerning the indexes. It was estimated that the editorial work would cost $75,000 annually and it appears that that amount may suffice for the next few years.

It is too early to predict the degree of completeness that may be achieved in this valuable service to biologists, but a very excellent beginning has been made and the enterprise surely deserves the hearty support of the association and of all members interested in biological work.

BURTON E. LIVINGSTON,
Permanent Secretary

MECHANICAL STANDARDS ADVISORY COUNCIL

SIXTY organizations having an interest in standardization in the mechanical engineering field were invited to join the Mechanical Standards Advisory Council. A large percentage of them accepted and sent official delegates to represent them at the permanent organization meeting which was held on Monday, December 3, in the Engineering Societies Building, New York.

What to standardize, when to standardize and how to standardize, to the general economic advantage and without embarrassment to the financially concerned interests in the mechanical field, are the basic questions which the mechanical industries undertook to solve.