Cancer research in our laboratories is the study of oxidation-reduction rhythm in vital systems as influenced by conditions of biological equilibrium and affected by catalysts, always considering the four component system of the cell and its environment. The foregoing may seem a simple sentence but it has taken me thirty years of my life to get there.

Continuation of experimentation along lines of the scientific method, in distinction to the trial-and-error method, can not but end in that consummation, devoutly to be wished for, a chemical cure for cancer, which, in my opinion, is only a matter of time and trouble. How much time and how much trouble remains to be seen. Cancer study is a problem in applied science which needs the united efforts of chemist, physicist, cytologist and biologist, and this cooperative and coordinated union in scientific effort is as much the product of American adaptability as is quantity production in manufactures. This united effort implies no deterioration in quality from so-called pure science, and is the united determination to solve a problem, even such a difficult one as cancer, by the assemblage of knowledge and mutual cooperation of scientific men and women.

DR. HILLEBRAND AS I KNEW HIM[1]

By Dr. E. T. ALLEN

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THE purpose of this occasion is to honor achievement, past and present. A more fitting memorial to Dr. Hillebrand could not have been conceived. We think of him as a man of achievement; other aspects of his comparatively uneventful life would have little interest for us.

In recalling briefly the outstanding formative influences of his career, those early years in Honolulu come to mind. Dr. Hillebrand was born in the Hawaiian Islands, less than a century after the white man first set foot on those shores. But if the circumstance of that early environment left any permanent impress on his temperament or his imagination, I have been unable to find it. Dr. Hillebrand rarely alluded to this period of his life. It seems to have been but an episode.

Dr. Hillebrand's father was a German physician who came to Honolulu for his health. He became deeply interested in the luxuriant tropical plant life about him; studied it; became an authority on the subject, and is to-day I believe the classic authority on the botany of the Hawaiian Islands. Dr. Hillebrand once told me that he had accompanied his father on many of his botanical expeditions, but that he never became interested in botany. However, the fact that his father was an intellectual man, of broad training, with the ability and the initiative to make himself an authority in any branch of science, must, I think, be counted an important influence in the after life of his son.

Dr. Hillebrand's formal education was unusually complete. After two preliminary years at Cornell University, he was sent to Germany in the early seventies, where he remained for six years. He studied at Strassburg and at Heidelberg. At Heidelberg, where he took his degree, he became a pupil of Bunsen and of Kirchhof, colossal figures in the world of science then, as they are to-day. Twenty-five years ago, as chairman of the program committee of this society, I prevailed upon Dr. Hillebrand to give us his recollections of Bunsen. He regretted that much of a personal character had faded from his memory, but he left no doubt in the minds of his listeners of the profound respect he bore to Bunsen and the powerful influence Bunsen had exerted on his own career.

To the German university Dr. Hillebrand doubtless owed much besides his purely technical training; ideals of thoroughness, accuracy and breadth. While perhaps not a man of the widest interests, he had a very broad perspective, much broader, I should say, than that of the ordinary professional man. Much of this, I think, was derived from the grand precept of the German university, that any department of human knowledge, no matter what its popularity, was entitled to the same respect as every other.

At Freiberg Dr. Hillebrand attended one of the most famous mining schools in the world, where he was grounded in such subjects as geology, assaying and metallurgy (metall'urgy, as he always called it after the German pronunciation).

In 1879, we find Hillebrand in Leadville, Colorado, one of the important ore-producing centers of the day, where he worked as an assayer. Shortly afterwards he joined the Geological Survey and a little later came to Washington where he remained in the government service to the end of his life.

I first met Dr. Hillebrand thirty years ago at the old Hooe Building on F Street, then occupied by the Geological Survey, since razed to make room for the National Press Club. Had you called on Dr. Hille-

[1] Delivered before the Chemical Society of Washington on the occasion of the award of the Hillebrand Prize to C. S. Hudson, March 26, 1931.

brand at that time, you would probably have come away with the feeling that he was not a very aggressive man, not especially social or entertaining, but refined, dignified and distinguished. On further acquaintance you would have found him pleasant in his personal relations and thoroughly satisfactory to cooperate with; a man of the highest integrity and conscientiousness. If you had had opportunity to watch him at his work, you would have been apt to find him sober, silent and absorbed. While not a man habitually gloomy, he was not noted for cheerfulness, optimism, exuberance or even enthusiasm. His most loyal friend would never have thought of proposing his name for the Rotary Club.

One of Dr. Hillebrand's outstanding qualities was intellectual honesty. I have rarely known a man so little apt to misrepresent or overstate the facts in order to score in an argument, or to overemphasize the importance of his own work.

A man essentially judicial in temperament, deliberative but not slow, he has surprised me by the speed with which he would grasp the gist of a scientific article; and in the laboratory work of the department none of his coworkers ever equalled his output.

For many years a pillar of this society, Dr. Hillebrand was not much inclined to join in its discussions, except perhaps when they concerned the American Chemical Society, and he never "gave talks." He habitually read from the manuscript papers carefully worked out. His distinguished figure, with the massive head and flowing beard, will not soon be forgotten.

In choosing analytical chemistry as his life work Dr. Hillebrand entered an old, old field and he usually approached it by well-worn paths. Not an innovator in the usual sense, he invented few new methods, devised little apparatus useful in his art. He will be remembered chiefly as a refiner and systematizer. Two important principles, neither of which was new with him, he was very fond of applying. One was the principle of double precipitation in gravimetric separations. Before reading Hillebrand's book I had thought of double precipitation as something to be used only in work of unusual accuracy, in especially skilful hands; otherwise just another opportunity for mechanical losses. From Hillebrand I learned that in many of the commonest separations, that was the wisest course to pursue. My ideal analytical method had been one that combined optimum conditions, suitable for all possible proportions of the two elements to be separated. Hillebrand convinced me that few such methods exist; but that by a single precipitation one could always come to the same case, namely, a great excess of the element to be determined and a minimum amount of the other. This case can be very easily handled.

Corrections have doubtless been applied to scientific measurements since early times, more frequently in those sciences where the measurements are characterized by a larger mechanical factor than they are in chemistry. Outside of special researches they had not been much used in chemistry before Hillebrand's time. He taught the importance of systematic corrections in all chemical work that made any pretension to accuracy.

It may interest some of you to know that Hillebrand attached no special importance to his manual skill. He once said that if he had any advantage over other men in his profession, it was not by reason of his skill of hand, but because of his broader experience—and, he might have added, his intelligence.

There was one circumstance in Dr. Hillebrand's environment at the Survey which might have seemed, to an outsider, a handicap, but which really proved an advantage to him. As long as he stayed at the Survey, despite the standing he had in his profession, he was always subject to call, for a certain amount of routine work. But this he made an opportunity for trying out his methods under all sorts of conditions and thereby bringing them to a higher state of perfection.

As a systematizer also, it seems to me, we owe much to Hillebrand. In a good course in qualitative analysis, if the student learns anything, it is *system*. In quantitative analysis, as formerly taught, he was given a book of fragmentary recipes. If he wanted to make a complete analysis, especially of some complex substance, he found no clear and logical course to follow. Hillebrand makes the course clear.

I have said that Hillebrand was not an innovator in the usual sense. Shakespeare was not much of an innovator. His plots are generally taken from earlier sources. Very little changed, you may find many of them in the works of the old chroniclers. Much of the dialogue in some of his plays may be found in Plutarch. Yet Shakespeare did something to those old stories. He didn't invent them; he transformed them. Not to the same degree, of course, but still in a very true sense I think it may be said that Hillebrand transformed the methods that he made his own. Taking many of his materials from the junk heap of tradition, he shaped them to his purpose and formed from them a tool which he sharpened into a precise instrument of wide application.

This is not all that Dr. Hillebrand did. He made important contributions to mineral chemistry. Later at the Bureau of Standards he began with Lundell a work of broader scope. But if he had done nothing

but his analytical methods, his fame I think would still be secure.

From conversation with Dr. Hillebrand many years ago, I learned that, even as a boy, he felt a strong predilection for chemistry. He apparently had a bent from which he was not to be turned aside by the allurements of botany or metallurgy. He followed that bent, and by the least spectacular of methods he achieved distinction.

This society may be said to have possessed its fair share of men whose work is of more than average merit, but I doubt if there is any other who has produced anything that is so often and so widely used as Dr. Hillebrand's analytical methods.

OBITUARY

MEMORIALS

AN international committee has been formed to establish a memorial to the late Albert Brachet, professor of anatomy and embryology in the University of Brussels, who died on December 27, 1930.

A correspondent writes: "Professor Brachet was noted for his work in the embryology of vertebrates and more particularly for his experiments on the early phases of development of the amphibian egg. His good sense, devotion and unusual personal charm won for him a high place in the councils of science and education. American colleagues who met him on his extended tour of the United States two years ago will long cherish his memory." The American members of the committee are: Professor E. G. Conklin, Princeton University; Professor Ross G. Harrison, Yale University; Professor F. R. Lillie, University of Chicago; Professor T. H. Morgan, California Institute of Technology; Professor E. B. Wilson, Columbia University.

The committee is asking for subscriptions to a fund to be used (1) to found a triennial or quadrennial prize, to be awarded for the best work appearing during that period in the field of embryology, especially that of causal embryology, open to the entire world and to be awarded by the Belgian Academy of Sciences, and (2) to place a memorial tablet to Professor Brachet in the entrance hall of the Institute of Anatomy in Brussels. To subscribers of one hundred francs or more a reduced replica of the medallion will be given. Student subscribers will receive the replica for gifts of fifty francs or more.

Subscriptions should be sent directly to MM. Philippson, Banquiers, 44 rue de l'Industrie, Brussels, Belgium, and marked "Manifestation Brachet."

WE learn from the *Journal* of the American Medical Association that a memorial auditorium named in honor of the late Dr. Henry Mills Hurd, for many years superintendent of the Johns Hopkins Hospital, is now in construction on the hospital grounds. The building, which will seat 200 persons with standing room for an additional 100, will be completed in the fall. A part of the equipment will be a device for projecting pictures from underground rather than from the rear. Thus the lecturer may illustrate with living models, without their appearing in view of the audience. The Hurd memorial was the gift of Mr. George K. McGraw.

A COMMITTEE of university professors is preparing the material for the publication of the "Complete Works" of Lazzaro Spallanzani, which will contain all the writings, published and unpublished, of the great biologist. It will not be a "critical edition" but will contain material calculated to show what is due to Spallanzani as regards the priority of scientific observations and discoveries. The first two volumes will be issued on the occasion of the International Congress of Physiology, which will be held in Rome in 1932.

THE review *Scientia* pays tribute to the memory of its late director, Dr. Eugenio Rignano, by founding a prize to be conferred after international competition upon the author of the best essay on "The Evolution of the Notion of Time."

RECENT DEATHS

DR. ARTHUR STARR EAKLE, professor of mineralogy at the University of California, has died in Honolulu at the age of sixty-seven years.

DR. WILLIAM JASPER SPILLMAN, agricultural economist of the U. S. Department of Agriculture, died on July 11. He was sixty-seven years old.

DR. EUGENE LYMAN FISK, medical director of the Life Extension Institute, New York City, died on July 6 at the age of sixty-four years.

THE death is announced of Dr. Harold E. Bemis, professor of veterinary surgery and obstetrics and dean of the School of Veterinary Medicine of the University of Pennsylvania.

SIR CHARLES HENRY BEDFORD, of Woking, England, formerly editor of *The Indian Medical Gazette* and professor of chemistry in the Medical Colleges of Calcutta and Lahore, died on July 8 at the age of sixty-five years.

Nature reports the death of C. T. Heycock, F.R.S., Goldsmiths' reader in metallurgy in the University of Cambridge, on June 3, aged seventy-two years; of Mr. W. F. Denning, authority on meteors and comets, on June 9, aged eighty-two years, and on June 9 of Dr. R. C. Macfie, author of works on biology, Thomson lecturer in the University of Aberdeen for 1929.