which made him peculiarly vulnerable to entrapment in the muck and peat deposits so common to the eastern woodlands of immediately post-glacial time. Whether he found that habitat endurable for a somewhat longer period than the European mammoth was able to survive in Europe, we do not know at present. But we do know that his life span did not extend into the time of the archeologically known horizons, and, in addition, we must confess that his presence in bogs on the southward drifts is not sufficient to clarify his age accurately enough that we may assert his survival into recent centuries.

These bogs can not be correlated with those of Scandinavia and the North German plain with anything like the necessary degree of exactitude which would validate Scott's assertion of extreme recency. We merely know that both are Post-Glacial in their particular latitudes, and that is all. There exists no evidence, at present, which seems to demand in the New World a lingering extinction of the American elephants in a way much different from the course of events in Europe. But it would be well to bear in mind, in future studies, that the eastern mastodon was a creature whose way of life was by no means entirely comparable to that of the mammoths. When this is realized, his more numerous presence in bogs on the early drift may be better understood. Moreover, it will reduce the tendency to make casual and ill-aimed comparisons between the sparsity of such remains in Europe and their frequency in the New World. The problem of mastodon antiquity will eventually be solved on other evidence. This writer is quite willing to admit that the solution is not evident at the present time, but he does not feel that the above facts can be made to fit into an easy and superficial dogmatism about the recency of survival of the American elephants within the last few centuries.

OBITUARY

JOSEPH CHRISTIE WHITNEY FRAZER

JOSEPH CHRISTIE WHITNEY FRAZER died in Baltimore on July 28, 1944. His death marks the loss of the last direct link with the Remsen influence. He is mourned with sadness at Johns Hopkins, and the activities and creative accomplishments of this great Hopkins chemist are hereby inadequately recorded by one of his friends.

An English Jesuit once said, "It is surprising how much good a man may do in the world if he allows others to take credit for it." The intense devotion of Frazer's students and associates is partly explained by his unselfishness, but the strength of the bond between him and his inner circle was largely the result of his kindly penetrating judgment. It was wisdom enriched by a voracious appetite for scientific literature and finely tempered with a sympathetic feeling for the vagaries of the human soul. The affectionate title "the Boss" was a feeble attempt by his students to express their belief in his wisdom and their faith in the gentleness of his rule.

J. C. W. Frazer was born on a farm in Kentucky on October 30, 1875. He attended Kentucky State College (later the University of Kentucky) in Lexington, from which he received the B.A. and M.A. degrees. It was here that his enthusiasm for chemistry was kindled by a great teacher, Joseph H. Kastle. It was this latter man who aroused in young Frazer a love for the robust form and vivid coloring of physical experiment. It was he who distilled into Frazer's thinking a strong tincture of scepticism, without which no modern man of science may guide himself through the welter of data and ideas.

Frazer then came to the Johns Hopkins where he worked under the direction of Ira Remsen and H. N. Morse. It is indicative of his mental processes that he did not follow the brilliant, highly articulate, encyclopedic Remsen, but rather the careful, precise technician Morse. The latter would lecture for months on the analytical balance, and for weeks on the Bunsen burner. After Frazer obtained his degree in 1901 he became assistant to Morse and proceeded to the task of the exact measurement of osmotic pressure. This painstaking work is recorded in numerous papers, but never can enough be said of the endless difficulties that beset the path of these two investigators. It was a struggle, with a most critical margin, against selective porosity. They succeeded brilliantly with some measurements, but finally, as the work progressed, it became evident that instead of being a fundamental clarifying concept in the theory of solutions, osmotic pressure was a complicated manifestation that could be simply characterized only in idealized cases. With his penetrating, uncanny knack of getting at the bottom of things Frazer clearly saw that the theory of solutions, especially electrolytes, demanded stronger tools of investigation than utopian semipermeable membranes, and accordingly turned to measurement of vapor pressure of true solutions and osmotic pressure of colloidal or high polymer solutions.

Here follows the only interruption of his Hopkins association—a four-year position as research chemist in the Bureau of Mines. It was here that the work of Frazer laid the foundation of exactness and experi-

mental rigor that have been associated with the activities of this great government institution.

Upon his return to Hopkins in 1911 he plunged into his long planned project of the exact measurement of the vapor pressures of aqueous solutions of non-volatile solutes. He selected the direct approach, *i.e.,* static measurements under conditions of exact temperature and freedom from permanent gases. His results still stand as a model of careful measurement. Once G. N. Lewis singled out Frazer's values as being not entirely accurate because of the fact that they did not obey a particular subjective method of thermodynamic graphic plotting. Lewis did not appreciate the important role of hydration of the solute, but this point did not escape the notice of Frazer, who took the position that the method of measurement was exact within the limit stated.

The vapor pressure work was interrupted by the advent of World War I, and inasmuch as the chemical war work originated in the Bureau of Mines it was an obvious choice to enlist the services of the Chemistry Department of the Johns Hopkins. Frazer selected once more an important problem, and also, characteristically, solved the same completely. Never was the nature of the man better illustrated than in his action in the ensuing years. He was a full professor and director of the Chemical Laboratories at this time, and positions of power and authority in the council of the men of science at war work were his for the asking. Yet he never turned aside from the pursuit of his immediate experimental goal, he never strove for high administrative office, he never tried to gain stature by any manifestation of showmanship, he remained his cool, contemplative self, always thinking of his experimental problem. The task selected by Frazer was the old one of low temperature oxidation of carbon monoxide. Since many minds were working on the problem, the history of the final conquest must therefore be complicated. All the other investigators firmly believed that the catalyst manganese dioxide would not function alone, but required the addition of promoters. To Frazer belongs the credit of being first to realize that *pure* manganese dioxide was the active agent, and was alone sufficient to bring about the oxidation. As soon as his initial period of investigation put him on the correct path, he proceeded forthwith to the final solution of the problem by a series of brilliant and highly ingenious experiments. The conclusion of the investigation produced the catalyst Hopcalite, named by Frazer and Bray (of the University of California) after their respective universities.

This outstanding experimental achievement turned Frazer definitely toward the baffling problem of heterogeneous catalysis in general. While this field was highly suitable for the display of his prodigious knowledge of inorganic chemistry, it is unfortunate that he did not turn his discerning experimental talents toward the solution of a problem not involving the extremely uncertain interpretation of kinetic measurements. Most great chemists have labored with the desire of correlating time with chemical changes of state, but up to the present the proper frame of conception has eluded them. Frazer was keenly aware of the imperfect state of our fundamental knowledge of catalysis and was constantly probing for a crucial opening wedge in the problem. He read and sifted all the theories, he studied many related phenomena, such as adsorption, surface energy, crystal structure and complex compounds. During all this time he contributed many important experimetal data.

At the time of his death he was deeply engaged in private experimental work of fundamental significance, as subsequent revelations will prove, and also had been for more than two years directing an N.D.R.C. investigation.

He was a man of few words, never having, as he was wont to say, the "gift of gab," but his words were always to the point at issue, and it seemed as if he distilled from his ever present pipe a subtle emanation that was clarifying and soothing. In his day he had been an outstanding athlete, but in his later years he remained closer to his laboratory where he taught and toiled. He loved the spirit of research which has always permeated Hopkins and was fond of quoting a remark of Professor F. G. Donnan, who once told Frazer that the Hopkins Chemistry Laboratory was one of the world's great experimental centers. Frazer's honesty was of such a caliber that he never fooled even himself; he knew the exact nature of his training and therefore his own capabilities. In fact, as he modestly put it, scientific research is only "a peep into the future."

WALTER A. PATRICK
THE JOHNS HOPKINS UNIVERSITY

RECENT DEATHS

DR. FRANK BLAIR HANSON, associate director of the Division of Natural Sciences of the Rockefeller Foundation, died on July 21 at the age of fifty-nine years.

DR. FREDERIC E. CLEMENTS, of Santa Barbara, Calif., from 1917 until his retirement in 1941 associate in ecological research of the Carnegie Institution, died on July 26. He was in his seventy-first year.

DR. ROSCOE GILKEY DICKINSON, professor of physical chemistry and dean of the Graduate School of the California Institute of Technology, died on July 13 at the age of fifty-one years.