varying from 3.97 to 5.18 per molecule of whatever substance may be responsible for the transmission of excitation in nerve. In other words, the number of quanta is about the same for a relatively simple physiological process influenced only by heat as it is for an equally simple physiological process that is influenced only by visible light radiations; that is, for carbonic acid assimilation by the green plant when the intensity of the incident rays is weak.

Putting these facts together it seems that the cogency of the problem set forth is established and that there can be no escape from the surmise that the frequency of dark-field radiations in a purely thermal process may play the same rôle that the frequency of visible radiations plays in a purely photochemical process.

This being the case then it would seem that the surmise could be put to the test of experiment by exposing a system, whose reaction is susceptible to thermal changes, to direct infra-red radiations. This indeed has been done by chemists and from their experiments no clear proof has yet been established that absorbed infra-red radiations affect the rate of chemical reaction.[1] However, it would seem that this does not exclude the possibility that with the discovery and application of new methods, the proof may yet be brought forth.

At the same time there is also the possibility that the application of heat to these "thermal systems" brings about radiation among the molecules themselves, that is, the increased force of molecular impacts may produce perturbation among the outer sphere of electrons of atoms, which leads to electron transfers. The atoms themselves thus become sources of radiation, the processes of emission as well as absorption all occurring within the system itself. That this is possible is suggested by the phenomena of chemiluminescence and bioluminescence whereby the application of a variety of external agents, none of which need be primarily radiant energy, the atoms or molecules within the system are brought to a state where they themselves become the source of visible light. If atoms and molecules can thus be made to emit visible radiations it would seem to be all the more probable that they oftener and more easily can be made to emit radiations of lower frequency, that is, infra-red radiations. But such radiations being invisible will be all the less easily demonstrated. Especially must this be the case where the emitted radiations are also absorbed by the same system. Here the chances of detection by a dark-field radiometer obviously become nil.[6]

V. SUMMARY

In the foregoing pages the writer has attempted to point out first, the importance to physiologists of the discovery and application to their problems of a unit of physiological activity to serve as a universal measure of life processes. Second, a survey of the field of excitation and response points to the probability that electron transfers are involved in every case and, therefore, that such a standard of measure, if ever determined, will probably involve terms of radiational units. Third, a brief statement of some of the laws of radiation that seem to be involved is given, together with a sketch of the radiation hypothesis of chemical thermal reaction. Fourth, an analysis of the data of a few physiological processes is then presented, the results of which strongly suggest the possibility that the influence of temperature upon living processes may be due to dark-field radiations quite as much as the photochemical effects in living processes are due to radiation of visible light.

OBITUARY

MEMORIALS

UNDER the leadership of Reginald P. Bolton, a committee has been organized to raise a fund of $25,000 to preserve the home of John James Audubon in New York City. It is planned to move the house to a city park to be used as a public museum.

A FUND is being collected in the Canal Zone for the purchase of an oil painting of General George Washington Goethals, to be hung in the administration building at Balboa Heights. It will be painted by Brigadier General Chester Harding, retired, a former governor of the Canal Zone, who, since leaving the service, has renewed his portrait studies in Paris.

Nature reports that a fête in honor of Henri Moissan was celebrated on October 4, in the cathedral town of Meaux, situated on the banks of the Marne. The delegates were received on October 3 at the Ministry of Foreign Affairs on the Quai d'Orsay, and on the following morning nearly three hundred were taken by special train to Meaux. The ceremonies included the formal presentation to the Communal College (of which Moissan was a pupil from 1864 until 1870) of a plaque on the wall of the entrance hall, and in the afternoon the unveiling, by Mme. Jean Gerard, of a monument in a small square by the side of the town hall. The monument is in the form of

[6] For a full presentation of the physical aspects of the topics dealt with in this paper see vol. 23, *Handbuch der Physik*, 1926, edited by Geiger; especially chapters 5, 6 and 7 by Pringsheim, Noddack, and Franck and Jordan, respectively.

an obelisk, from the upper part of which the features of Moissan emerge from the solid stone, while on the side are sculptured diagrammatic representations of his electric furnace and of the apparatus with the help of which he isolated fluorine, with quotations from his writings. Discourses were delivered under the direction of Professor Behal, representing the minister of public instruction. The first three were by the president of the organizing committee, by the mayor of Meaux, and by the president of the old students' association of the College of Meaux; the others were by M. Lebeau, the assistant and colleague of Moissan, representing the friends and students who had worked in Moissan's laboratory, by Professor Hönigschmid, of Munich, who was a former student of Moissan, on behalf of the foreign delegates and by Professor Behal on behalf of the government.

RECENT DEATHS

DR. SAMUEL RAYNOLDS PARSONS, professor of physics at the University of Arkansas for the last eight years, died on October 10. He was forty-three years of age.

DR. JAMES SIMPSON CHESTER WILLS, metallurgical engineer, at one time adjunct professor of analytical chemistry at Columbia University, died on October 29, aged eighty years.

DR. SAMUEL MATHER, pioneer in the development of the iron mining and steel industries and the Great Lakes shipping fleets, has died at the age of eighty years.

DR. JOHN J. DUNPHY, specialist in pediatrics and instructor of pediatrics at the Harvard Medical School and Tufts Medical School, died on October 13 at the age of thirty-eight years.

MR. JAMES LONG, formerly professor of dairy farming at the Royal Agricultural College in Cirencester, died on October 1. Mr. Long was eighty-five years of age.

MR. J. W. TAYLOR, of Leeds, England, known for his work on conchology, died on September 2 at the age of eighty-seven years.

THE death is announced of Dr. Josef Bayer, director of the division of anthropology and prehistory in the State Museum of Natural History in Vienna, and editor of the journal *Eiszeit*.

PROFESSOR GUIDO HOLZKNECHT, head of the Vienna Roentgen Institute, died on October 30 at the age of sixty years.

SCIENTIFIC EVENTS

APPROPRIATIONS FOR GRANTS-IN-AID BY THE NATIONAL RESEARCH COUNCIL

AT its meeting in October the National Research Council's committee on grants-in-aid made grants for the support of research as follows:

To Thomas B. Brown, professor of physics, George Washington University, cathodofluorescence; E. Hobart Collins, professor of physics, Parsons College, the resonance radiation of mercury.

To H. F. Moore, professor of engineering materials, University of Illinois, the effect of repeated stresses on nickel-chromium steels under high temperatures.

To W. L. Beuschlein, professor of chemical engineering, University of Washington, the hydrogenation of coal in various dispersion media; Richard Bradfield, professor of soils, and W. G. France, professor of chemistry, Ohio State University, size distribution in soil particles; Samuel C. Lind, director of the school of chemistry, University of Minnesota, the chemical reactions produced in gases and other dielectrics by passage of electrical discharge; James W. McBain, professor of chemistry, Stanford University, development of an ultra-centrifuge.

To Harold L. Alling, professor of geology, University of Rochester, the optical properties of feldspars; Julia Gardner, geologist, U. S. Geological Survey, Eocene faunas of northern Mexico; Elbridge C. Jacobs, professor of geology and mineralogy, University of Vermont, installation of a seismograph at the University of Vermont; E. M. Kindle, chief, division of paleontology, Geological Survey of Canada, a bibliographic index of North American Devonian fossils; Asa A. Lee Mathews, assistant professor of geology, Oberlin College, Paleozoic stratigraphy and paleontology of Giles County, Virginia; Joseph T. Singewald, Jr., professor of economic geology, the Johns Hopkins University, petrographic investigations of rock specimens from the Andes of central Peru.

To J. McA. Kater, assistant professor of zoology, Washington State College, the functional significance of mitochondria; Reginald D. Manwell, assistant professor of zoology, Syracuse University, avian malaria; W. D. Salmon, research professor of animal nutrition, Alabama Polytechnic Institute, the relation of vitamin B to carbohydrate metabolism; Bruce Webster, assistant professor of medicine, Tulane University School of Medicine, the nature of a goiter-producing substance found in cabbages.

To Alan A. Boyden, assistant professor of zoology, Rutgers University, serological study of the early development of the chick; E. B. Copeland, research associate in the department of botany, University of California, the Old World species of the fern genus *Trichomanes;* Berwind P. Kaufmann, professor of