a forest fire in a mountainous section of the Clearwater National Forest in Idaho on August 21. He had won his way to rank of staff officer by thorough analyses of fire records and by originating fire control planning methods over a period of years in the field and at the Northern Rocky Mountain Forest Experiment Station. His report, "Fire Control Planning in the Northern Rocky Mountain Region," in 1936, engendered widespread interest. He was appointed to the position of fire control planning specialist for the Forest Service as a whole in March, 1937. Hornby was born in Iowa fifty-one years ago, reared on a California ranch and received his degree as civil engineer at the University of Michigan. In 1915 he received his master's degree in forestry. He rose literally from the ranks, was an indefatigable worker and a man of clear and original thinking. At the time of his death he had made great progress on the assignment to perfect the technique for fighting forest fires by bringing the newest scientific developments into forest fire control and by coordinating the results of fire-fighting experience gained by foresters in the past thirty years.

SCIENTIFIC NOTES AND NEWS

DR. ROBERT GRANT AITKEN, director emeritus of the Lick Observatory, was elected president of the American Astronomical Society at the recent meeting at Williams College. He succeeds Dr. Henry Norris Russell, of Princeton University. Dr. Frank E. Ross, of the Yerkes Observatory, was elected vice-president; Dr. John C. Duncan, of Wellesley College, secretary, and Dr. F. C. Jordan, of the Allegheny Observatory, treasurer, were reelected. Leon Campbell, of Harvard Observatory, Dr. E. F. Carpenter, of the Steward Observatory, and Dr. A. H. Joy, of the Mount Wilson Observatory, were elected members of the council. Dr. W. D. MacMillan, of the University of Chicago, was chosen to represent the society on the National Research Council.

DR. HERMANN HOLTHUSEN, of Hamburg, has been elected president of the sixth meeting of the International Congress of Radiology, to be held in Berlin in 1940. He succeeds Dr. Arthur C. Christie, of Washington, formerly professor of clinical radiology in the Medical School of Georgetown University, who presided over the meeting held in Chicago from September 13 to 17.

DR. HOWARD P. DOUB, of the Henry Ford Hospital at Detroit, was inducted at the Chicago meeting as president of the Radiological Society of North America, to succeed Dr. John D. Camp, of the Mayo Clinic, Rochester, Minn.

AT the recent meeting at Chicago of the American Roentgen Ray Society its gold medal was awarded to Dr. Aubrey O. Hampton and Dr. J. Maurice Robinson, of Boston. A silver medal was presented to Dr. Robert B. Taft, of Charleston, S. C., and a bronze medal was shared by Dr. Warfield T. Longcope, Dr. John W. Pierson and Dr. Charles D. Smith, all of Baltimore. At the session on September 13 Dr. Hans R. Schinz presented the honorary degree of doctor of laws of the University of Zurich to Dr. William D. Coolidge, director of the laboratories of the General Electric Company, in recognition of thirty years of research and development of x-ray tubes and particularly for recent work on high-voltage x-ray tubes for the treatment of cancer and other diseases.

DR. KARL F. MEYER, chairman of the department of bacteriology and director of the Hooper Foundation for Medical Research at the University of California, was awarded the honorary degree of doctor of medicine by the medical faculty of the University of Zurich on the occasion of the celebration of International Medical Week in Switzerland. It was conferred in recognition of his work and public service in the field of communicable diseases transmissible from animal to man.

DR. ALBERT R. MANN was the guest of honor at the annual farm dinner of Jerome D. Barnum, publisher of the *Post-Standard*, Syracuse, N. Y. Three hundred guests, including leaders of forty-five agricultural organizations, state departments and educational institutions, joined in the tribute. Dr. Mann was for fifteen years dean of the New York State College of Agriculture and became provost of Cornell University in 1931. He resigned last June to become vice-president and director for southern education of the General Education Board. Speakers at the dinner included Governor Herbert H. Lehman; Dr. Liberty Hyde Bailey, of Ithaca, formerly dean and director of the State College of Agriculture; Louis J. Taber, of Columbus, Ohio, master of the National Grange; Dr. Harlan H. Horner, of Albany, assistant commissioner of education, and Jared Van Wagenen, Jr., formerly president of the New York State Agricultural Society. The speakers were introduced by Edward S. Foster, secretary of the New York State Farm Bureau Federation and of the State Agricultural Conference Board.

THE Johns Hopkins University School of Engineering has announced additional courses in civil, chemical and gas engineering. New appointments to the faculties are as follows: Dr. Abel Wolman, professor of sanitary engineering; Dr. P. H. Emmett, professor of chemical and gas engineering; Dr. C. F. Bonilla and

Dr. R. K. Witt, associates in chemical and gas engineering.

FRANCIS X. SCHUMACHER, chief of the Division of Forest Measurements, has resigned from the Forest Service to accept a professorship at the School of Forestry of Duke University. Mr. Schumacher, during his seven years with the Forest Service, has been largely instrumental in adapting Dr. R. A. Fisher's methods of experimental design and analysis of variance to forestry problems.

PROFESSOR M. A. SHARP, of the department of agricultural engineering at the Iowa State College, has become head of the department of agricultural engineering of the University of Tennessee.

DR. JULIUS SENDROY, JR., formerly associate in chemistry at the Hospital of the Rockefeller Institute for Medical Research, has been appointed professor of chemistry and head of the department of experimental medicine at Loyola University School of Medicine, Chicago.

DR. WILLIAM E. TAYLOR has been appointed full-time health director and instructor in bacteriology and physiology at the Southwest Missouri State Teachers College at Springfield. Dr. Taylor, who will give up his private practice, is the son of J. A. Taylor, founder of the Springfield Normal School, which preceded the State Teachers College.

DR. SAMUEL HERRICK, JR., has been appointed an instructor in the department of astronomy of the University of California at Los Angeles. He will teach courses in practical and mathematical astronomy. During the spring quarter of 1937, he served as visiting instructor in the department of astronomy of the University of Washington at Seattle.

DR. GEORGE BARGER, since 1919 professor of chemistry in relation to medicine at the University of Edinburgh, will take up his work as regius professor of chemistry in the University of Glasgow on October 1. He succeeds Professor George Gerald Henderson, whose resignation will take effect on September 30.

DR. FREDERICK W. PARSONS, New York State commissioner of mental hygiene since 1927, has tendered his resignation to take effect on October 1. Dr. Parsons was appointed superintendent of the Buffalo State Hospital in 1919. In 1926 he was made medical commissioner of the New York State Hospital Commission and in 1927 commissioner of mental hygiene.

A DEPARTMENT of wild game has been established in the School of Agriculture of the Agricultural and Mechanical College of Texas at College Station. It will be under the direction of Dr. Walter P. Taylor, senior biologist of the Biological Survey, who is in charge of the cooperative research unit established under the auspices of the Bureau of Biological Survey of the U. S. Department of Agriculture, the American Wildlife Institute and the Texas Game, Fish and Oyster Commission. Dr. W. B. Davis, who has had experience in wild-life work in Idaho, Washington and California, has been made a professor in the new department.

The Experiment Station Record reports that Dr. Clarence Dorman, assistant director in charge of research and chief agronomist, has become assistant director of the Mississippi experiment stations in succession to W. R. Perkins. In the sub-stations, E. B. Ferris, extension agronomist, has succeeded the late C. T. Ames as superintendent at Holly Springs, and H. C. McNamara, superintendent of the U. S. Cotton Field Station at Greenville, Texas, has succeeded W. E. Ayres as superintendent at Stoneville.

DR. ALEŠ HRDLIČKA, of the U. S. National Museum, has returned from his ninth-season's work in southern Alaska and the Aleutian Islands. He reports that the expedition, on which he was accompanied by six volunteer students from different colleges, reached as far as the Commander Islands, where the Russians gave the party much friendly assistance. The two most important results of this year's work in the Aleutian chain were the discovery, on a series of the Central and Western Islands, of a hitherto unsuspected strain of people that lived in those islands before the Aleuts; and the find of a so far unknown chipped stone culture on one of the westernmost American islands. The expedition received invaluable aid from the U. S. Coast Guard and the U. S. Navy.

DR. RAYMOND LEE DITMARS, curator of mammals and reptiles of the New York Zoological Society, sailed for Panama on September 16. He plans to visit the area of the Madden Dam, to investigate the returning growth of the jungle during the last two or three years over the area which had been completely cleared. In Bilboa he will speak before the Panama Natural History Society on "Vampire Bats."

DR. ADOLPH R. RINGOEN, associate professor of zoology at the University of Minnesota, has leave of absence for the coming academic year. He plans to work at the Harvard Biological Laboratories.

THE Russel D. Carman lecture of the Radiological Society of North America was delivered at the annual banquet of the society by Dr. George W. Holmes, clinical professor of roentgenology at the Harvard Medical School.

DR. ANTON J. CARLSON, professor of physiology at the University of Chicago, gave an address entitled "The Physiologist Looks at Physical Therapy" at the sixteenth annual session of the American Congress of

Physical Therapy, held in Cincinnati from September 20 to 24.

DR. FREDERICK C. LEONARD, chairman of the department of astronomy of the University of California at Los Angeles and ex-president of the Society for Research on Meteorites, lectured on meteorites before the Vancouver Center of the Royal Astronomical Society of Canada on the evenings of August 10 and 23. The first lecture was given at the University of British Columbia and was open to students of the summer session of the university, during which Dr. Leonard was visiting professor; the second was given at Victoria College, an affiliated institution of the university.

THE tenth annual meeting of the Committee on Electrical Insulation of the Division of Engineering and Industrial Research of the National Research Council will be held in New York City on November 4 and 5. For this meeting the committee will be the guests of the Consolidated Edison Company of New York. There will be two technical sessions on Thursday and one on Friday. The speaker at the annual dinner will be Dr. A. von Hippel, of the Massachusetts Institute of Technology. The afternoon of Friday will be devoted to committee conferences and to visits of inspection. Dr. John B. Whitehead, of the Johns Hopkins University, is chairman of the committee.

AN American Association of Applied Psychologists was organized at Minneapolis on August 30 and 31. It succeeds the Association of Consulting Psychologists and will continue the *Journal* of that society, but consists of four sections covering the chief fields of application of psychology. About four hundred psychologists were in attendance at the organization meetings. Dr. Douglas Fryer, of New York University, was chosen president, Dr. Horace B. English, of the Ohio State University, executive secretary, and Dr. Edward B. Greene, of the University of Michigan, treasurer. The section chairmen chosen were: *Clinical,* Dr. Andrew W. Brown, of the Institute of Juvenile Research of Illinois; *Consulting,* Dr. Richard H. Paynter, Jr., Long Island University; *Educational,* Dr. P. M. Symonds, Columbia University; *Industrial and Business,* Dr. H. E. Burtt, the Ohio State University.

AT the seventh annual meeting of the American Malacological Union, which was held in the Museums Building of the University of Michigan on August 3, 4 and 5, the following council was elected: *President,* Dr. Carlos de la Torre, Museo Poey, University of Havana; *Vice-president,* Dr. Maxwell Smith, Lantana, Fla.; *Corresponding Secretary,* Norman W. Lermond, Knox Academy of Arts and Sciences, Thomaston, Maine; *Financial Secretary,* Mrs. Harold R. Robertson, Buffalo Museum of Science; *Councillors at large,* Dr. Henry van der Schalie, University of Michigan; Dr. Fred Baker, Point Loma, Calif., and Dr. Horace B. Baker, University of Pennsylvania; *Honorary and Past-presidents,* Mrs. Ida S. Oldroyd, Stanford University; Dr. Henry A. Pilsbry, Academy of Natural Sciences, Philadelphia; Dr. Paul Bartsch, Smithsonian Institution; Professor Junius Henderson, University of Colorado Museum; William J. Clench, Museum of Comparative Zoology, Cambridge, Mass.; Dr. Calvin Goodrich, University of Michigan Museum of Zoology, and Joshua L. Baily, Jr., San Diego. The eighth annual meeting will be held in Havana, Cuba, in 1938, dates to be announced.

THE United States Civil Service Commission announces open competitive examinations for the positions of senior engineer, at a salary of $4,600 a year; of engineer, at $3,800; of associate engineer, at $3,200, and of assistant engineer, at $2,600. Applications must be on file at Washington not later than October 11. Vacancies in these positions in Washington, D. C., and in the field, and in positions requiring similar qualifications will be filled from these examinations, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer or promotion. The salaries named are subject to a deduction of 3½ per cent. toward a retirement annuity. Separate lists of eligibles will be established in each grade for various branches of engineering. A limited number of vacancies exists at present in the following fields: Hydraulics, elevators, explosives, safety, air conditioning and ordnance. These vacancies, as well as future vacancies in all fields of engineering, will be filled as a result of these examinations. The work required is to perform, or supervise the performance of, professional engineering work in design, construction, survey, research and investigation in various branches of engineering. The difficulty of the work performed, the degree of supervision to which the employee is subject, or which he exercises, and the responsibility assumed, will vary with the grade of the position. Further information can be obtained from the commission.

THE French Society of Dermatology and Syphilology announces that an anonymous donor has made available a prize of 5,000 francs to be awarded every two years to the author of the best work, either printed or in manuscript form, on a subject in dermatology or syphilology representing a real advance in science. The prize will be awarded for the first time at the general assembly of the society in May, 1939. The subject chosen is "The Processes of Sensitization and Immunization in the Epidermomycoses." French and foreign authors are eligible to compete for the prize. The secretary general of the society is Dr. Pierre Fernet, 11 rue de Sontay, Paris.

THE Horace H. Rackham Fund of the University of Michigan has made an annual gift of $10,000 to a new clinic for the study of rheumatism. Dean A. C. Furstenberg, of the Medical School, has appointed a committee to take charge of the work and has placed Dr. Richard H. Freyberg at its head. Other members are: Dr. Cyrus C. Sturgis, director of the department of internal medicine; Dr. Harley A. Haynes, director of the University Hospital, and Dr. Carl E. Badgley, of the department of surgery.

DISCUSSION

LIFE; A PHOTOCHEMICAL STEADY STATE

THE assumption that living systems obey the second law of thermodynamics is made, at least tacitly, by most biologists, but is occasionally questioned by physicists and chemists. There is a great amount of experimental evidence to support the assumption, and none that definitely opposes it. Thus all opposition is based on theoretical argument, and a brief reconsideration from such a standpoint seems justified.

Actually, the system to be studied is somewhat different from those ordinarily postulated for thermodynamic treatment. From an energetic point of view it is not correct to consider living organisms inclusively, as an isolated system limited to the surface of the earth; they should be treated as a coupled system including both the sun and the earth. The free energy used for virtually all life processes is derived from sunlight through the photosynthetic activity of plants, the free energy so obtained being spent by both plants and animals. The accumulation and expenditure of free energy appear to be virtually equal, so that the total process may be considered roughly as a photochemical steady state. The chemosynthetic organisms may be excluded from the picture as comprising only a very small part of the total energy exchange; they do not disobey the second law of thermodynamics.[1]

The difference in temperature between sun and earth makes it possible to convert the energy of sunlight into chemical energy. The sun may be assumed to be a black-body at 6000° K, the maximum radiation from which is emitted at the wave-length 4800 Å, according to Wien's displacement law: $T \times \lambda_{max} = 0.2884$ cm. deg., where T is the absolute temperature and λ_{max} the wave-length of maximum emission. The earth may be assumed to be a black-body at 288° K, whose maximum emission is at 100,000 Å. The quantum of energy is inversely proportional to the wave-length ($e \times hc/\lambda$, where e is the quantum, h is Planck's constant, c is the velocity of light and λ the wave-length), so that the energy of the quantum for 4800 Å is twenty times that for 100,000 Å, the values being, respectively, 3.9×10^{-12} and 2.0×10^{-13} ergs. Since the temperature of the earth is virtually constant, it must radiate the same quantity of energy which it receives from the sun, but the quanta radiated must be smaller and more numerous than those received. For the latter reason the energy radiated by the earth must be considered to be more random in character than that received from the sun, which allows for the capture of free energy by the plant in the course of degradation of energy from larger to smaller quanta. Considered more specifically, a great part of the quanta in sunlight are of magnitude sufficient to produce changes in the electron orbits of those molecules which absorb them, and thus to produce photochemical reactions, whereas the reradiated quanta are not of sufficient magnitude to bring about such changes. Since the quantum is directly absorbed by the molecule, photochemical reactions, unlike thermal reactions, may go with an increase of free energy. Opportunity for the efficient capture of the energy of sunlight is thus provided, and plants have developed appropriate mechanisms which accomplish this.

It seems, then, that the complexity of the living world, which has been the basis of most arguments against the application of the second law of thermodynamics to living organisms, is only made possible by processes for which the degradation of energy is obligatory; and that the energy exchange of the total system is not contrary to the second law of thermodynamics.

If life is considered as a photochemical steady state, it seems to offer no exception to the second law of thermodynamics, unless many photochemical reactions *in vitro* also constitute such exceptions. The problem of the maintenance of such a steady state offers less difficulties to a thermodynamic approach than the problem of the development of complex living systems through evolution from less complex systems. However, as the writer has pointed out elsewhere,[2,3] the latter problem may also be approached from such a standpoint.

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[1] Baas-Becking and Parks, *Physiol. Rev.*, 7: 66, 1927.

[2] Blum, *American Naturalist*, 69: 354, 1935.

[3] Blum, *American Naturalist*. In press.

COAL IN GLACIO-FLUVIAL DEPOSITS IN OHIO

DURING an investigation of molding sands in the vicinity of New Philadelphia, Ohio, for the Mus-