more and better chosen illustrations will be incorporated.

The reviewer has a guilty feeling in making these few derogatory comments because the authors have made an honest effort to achieve their purpose and have succeeded so well that the general reaction is one of gratitude for having placed on the market a book of such usefulness. The reviewer commends it to medical students and to the medical profession in general. For biochemists and pathologists it should serve to present admirable perspectives of each other's activities.

S. B. WOLBACH

HARVARD MEDICAL SCHOOL

CELLS

Unresting Cells. By R. W. GERARD. xv + 439 pp. New York: Harper and Brothers. $3.75. 1940.

THIS book is a straightforward, lucidly illustrated account of the structure, function, growth and reproduction of cells from the view-point of a physiologist. The author's reasons for writing a book of popular science are set forth in his preface as follows: "the scientist—yes, the pure scientist—is not merely justified in spending some energy on the popularization of sound science, but even more, has some duty to civilization to do so," . . . for, "scientists must help recruit men in other walks of life to the method and attitude of science in dealing with problems of state and society."

Following a brief account of the characteristic properties of protoplasm, two chapters deal with the structure and simpler chemistry of protoplasm. Enzymes, their nature and activities, are treated in a long chapter which prepares the way for an account of metabolic processes. The questions of energy sources and the conversion of energy which crept into the previous chapters are then considered, with emphasis on the concept of free energy. Thus half of the volume is devoted to the more strictly physico-chemical aspects of cells.

The remainder of the book consists of an excellent account of irritability and behavior, an account of the structure and differentiation of cells as seen through the microscope, and then proceeds to the problems of reproduction and inheritance. The latter, treated largely as problems of the reproduction and inheritance of molecules, are superbly done.

The illustrations are consistently good, the lighter note in some of the drawings serving to get the layman over certain difficult bits of terrain. The drawing for the chapter head on heredity represents chromosomes of the giant salivary gland type (which never undergo mitotic division) in the process of dividing. This is the only striking inaccuracy in the book and will prove tantalizing to those cytologists who would like to see such chromosomes undergo division. There is a good index.

This is a stimulating volume which will be read with great interest by students of science as well as the layman, for Professor Gerard writes with clarity and enthusiasm, as well as with purpose.

D. F. POULSON

YALE UNIVERSITY

REPORTS

AWARD OF GUGGENHEIM FELLOWSHIPS FOR 1941

EIGHTY-FIVE fellowships with grants of funds amounting to $180,000 to assist research and creative work to be carried on in the year 1941–42 by American and Canadian scholars and artists are announced by the John Simon Guggenheim Memorial Foundation. Last year seventy-three fellowships were granted and fifty-eight were awarded in 1939. The recipients were selected from more than fourteen hundred applicants. This is the sixteenth annual series of fellowship awards by the foundation, which was established and endowed by former United States Senator and Mrs. Simon Guggenheim as a memorial to a son.

The Guggenheim fellowships are granted to scholars and artists who by their previous work have shown themselves to be persons of unusual ability. Men and women, married and unmarried, of all races and creeds, who are citizens or permanent residents of the United States, citizens of Canada and of certain Latin American countries, are eligible on equal terms. The fellows are usually of ages between 25 and 40 years. This year their average age is thirty-six years. The stipends are usually $2,500 for a year.

Since its establishment sixteen years ago the foundation has granted 1,017 fellowships with stipends amounting to about $2,300,000.

The following fellowships in the sciences have been awarded:

DR. CORNELIUS BECKER PHILIP, medical entomologist in the U. S. Public Health Service, stationed at the Rocky Mountain Laboratory, Hamilton, Mont., who will prepare a book on ticks and their relation to animal and human disease. He will work in Mexico, Colombia and Brazil.

DR. EDWARD HOLLAND SPICER, instructor in anthropology in the University of Arizona, will prepare a comparative study of the influences of contact with other cultures upon the Yaqui Indian communities of Mexico and Arizona.

DR. ISABEL TRUESDELL KELLY, of the University of

California, who is now in the State of Jalisco, Mexico, as a Guggenheim fellow, has been granted a second fellowship to enable her to continue her ethnographic and archeologic investigations there.

DR. MARGARET H. FULFORD, assistant professor of botany in the University of Cincinnati, will make a taxonomic study of the Hepaticae—liverworts—of Mexico and Central America, with the purpose of filling a gap in the existing botanical knowledge of the region.

DR. ARISTID V. GROSSE, of the Laboratory of Physics of Columbia University, formerly associate director of research for the Universal Oil Products Company, is working on the utilization of a close relative of the element uranium, known as U-235, as a source of power. This is the second Guggenheim fellowship to assist this work.

DR. HARVEY ELLIOTT WHITE, associate professor of physics, University of California, will make a spectroscopic analysis of the gases of the volcano Mauna Loa.

DR. MERRILL KELLEY BENNETT, professor of economic geography, Food Research Institute, Stanford University, proposes to investigate representative diets in the Hawaiian Islands and to contrast these with Oriental and Occidental diets.

DR. ADRIANCE SHERWOOD FOSTER, associate professor of botany, University of California, will go to Hawaii to make a cyto-histological study of the growth of buds of tropical ferns.

DR. ROY FRANKLIN BARTON, teacher of mathematics, St. Andrew's High School, Sagada, P. I., will record and translate the "Hudhud," a series of epics chanted as work songs and at death wakes by the Ifugaos, a pagan, terrace-building people of the Philippine Islands.

DR. DOROTHY MARY SPENCER, lecturer in anthropology, University of Pennsylvania, is engaged in studying, from an anthropological point of view, the Mundas, an aboriginal people who live on the high plateaus of Bengal, India.

DR. MAUD WORCESTER MAKEMSON, chairman of the department of astronomy and director of the Observatory of Vassar College, for researches into problems of Maya astronomy.

DR. ALFRED TARSKI, refugee mathematician from Poland, where he was professor of mathematics in the University of Warsaw, studies in the field of mathematical logic and the logical foundations of mathematics.

DR. DEANE MONTGOMERY, associate professor of mathematics, Smith College, studies of the action of topological transformation groups on various types of spaces, particularly on Euclidean spaces and manifolds.

DR. RICHARD DAGOBERT BRAUER, assistant professor of mathematics, University of Toronto, studies in the field of modern algebra, with special reference to the theory of groups of finite order and their characters.

DR. JESSE DOUGLAS, mathematician, Brooklyn, research in the calculus of variation and geometry.

DR. KENNETH STEWART COLE, associate professor of physiology, Columbia University, and consulting physicist, Presbyterian Hospital, New York City, for a study of the electrical aspects of the structure and function of living nerve.

DR. BERRY CAMPBELL, assistant professor of anatomy, University of Oklahoma Medical School, for investigations of the integrative mechanisms of the spinal cord with particular reference to the basic locomotor behavior patterns. Dr. Campbell will work at the Rockefeller Institute for Medical Research with Dr. Herbert S. Gasser.

DR. BENJAMIN PAUL SONNENBLICK, research zoologist, Queens College, New York, for studies of the embryology of the fruit-fly, *Drosophila melanogaster*, with special reference to the cytology and differentiation of the organs and organ systems in the larva.

DR. HORACE ALBERT BARKER, assistant professor and assistant soil microbiologist, University of California, for researches in the field of bacteriological biochemistry.

DR. ISRAEL LYON CHAIKOFF, associate professor of physiology, University of California, for investigations with radioactive phosphorus and iodine as indicators of metabolic processes in animals and for the preparation of a monograph on the physiological and biochemical aspects of the lipid metabolism.

DR. JOHN THOMAS MEDLER, entomologist, Ruidoso, New Mexico, for an investigation of the nutritional requirements and the chemistry of salivary secretions of certain insects.

DR. ERNST CLEVELAND ABBE, associate professor of botany in the University of Minnesota, for the continuation of his researches on the bearing of historical, climatic and geological factors on the vegetation of a heavily glaciated region in the eastern subarctic.

DIETRICH BODENSTEIN, who is a technician in the biological laboratory of Stanford University, for investigations into the problem of metamorphosis in insects.

DR. WILLIAM CHRISTIAN KRUMBEIN, assistant professor of geology, University of Chicago, will investigate the dynamical processes by which sedimentary particles are abraded, changed in shape and sorted into the deposits found in nature.

DR. GEORGE PRIOR WOOLLARD, geophysicist, Princeton, New Jersey, will make seismic, gravitational and magnetic investigations of the geologic structure underlying the North American Atlantic coastal plain.

DR. SOLOMON E. ASCH will prepare a book on the formation and change of opinion and attitude.

DR. EDWARD GIRDEN will make a comparative investigation of the neuropsychological determinants of the phenomena of dissociation.

DR. GEORGE KATONA, of New York City, will continue his studies in the field of the psychology of learning.

DR. RUDOLF ARNHEIM, a refugee psychologist from Germany, will study the application of the principles and methods of Gestalt psychology to art analysis.

DR. VOLNEY COLVIN WILSON, instructor in physics, University of Chicago, a study of the development of machinery for the production of high energy x-rays.

DR. WILSON MARCY POWELL, assistant professor of physics, Kenyon College, Gambier, Ohio, cosmic ray research, in particular a cloud-chamber study of the abundance and energy distribution of slow protons and mesotrons at high altitudes.

DR. WILLARD FRANK LIBBY, assistant professor of chemistry, University of California, studies in physical chemistry, with particular reference to application of the methods of nuclear physics.

DR. VERNER FREDERICK HENRY SCHOMAKER, senior research fellow, California Institute of Technology, studies in the field of molecular spectroscopy.

The trustees of the foundation, in addition to its founders, Senator and Mrs. Simon Guggenheim, are Francis H. Brownell, Carroll A. Wilson, Charles D. Hilles, Roger W. Straus, Charles Earl, John C. Emison and Medley G. B. Whelpley. The committee of selection consisted of Dr. Frank Aydelotte, director of the Institute for Advanced Study, *Chairman;* Dr. Florence R. Sabin, of the Rockefeller Institute for Medical Research; Professor Edwin Bidwell Wilson, of the School of Public Health of Harvard University; Professor Linus Pauling, of the California Institute of Technology, and Professor Wallace Notestein, of Yale University.

The fellows chosen this year come from twenty-three states and three Canadian provinces and are on the staffs of thirty-one educational institutions. The University of California at Berkeley leads with six members of its faculty appointed to fellowship. No other university faculty received more than two appointments.

In addition to these fellowships twenty fellowships were awarded later to Latin American scholars and artists in the twelfth annual Latin American Fellowship competition. All these fellows will work in the United States, and fourteen fellows from the United States will work in various parts of Latin America during the year. The stipend of the Latin American fellowships is usually $2,000 for a year's fellowship. The twenty fellowships awarded this year are distributed as follows: eight to Brazil, four to Mexico, three to Argentina, two each to Uruguay and Puerto Rico and one to Chile. The Committee of Selection consisted, in addition to Dr. Aydelotte, *chairman,* of Dr. Thomas Barbour, director of the Museum of Comparative Zoology, Harvard University, Dr. Percival Bailey, profesor of neurology and neurosurgery, University of Illinois Medical School; Dr. Américo Castro, professor of Spanish, Princeton University, and Dr. Elmer Drew Merrill, professor of botany and director of Botanical Collections, Harvary University. In making their selections, this committee was assisted by many eminent Latin American scholars and authorities in the fields of the applicants' work.

This year's list contains the largest number of Latin American fellowships ever awarded by the foundation in any one year. With the eighty-five fellowships awarded to citizens of the United States and Canada, it brings the total number of fellows assisted by the Foundation this year to one hundred and five. The largest group of the new fellows will work in medical fields. They are:

DR. ANÍBAL SILVEIRA, neurologist at the Juquerí Hospital in São Paulo, Brazil. He will study the electrical activity of the cortex of the brain and its variations under pathological conditions. Another neurologist who has been awarded a fellowship is DR. NILSON TORRES DE REZENDE, of Pernambuco, Brazil, who will continue his investigations in the field of neuro-physiology.

Two fellows will work in collaboration with Dr. George W. Corner, director of the Laboratory of Embryology of the Carnegie Institution, in Baltimore. They are: DR. WASHINGTON BUÑO, head of the laboratory of histology, Institute of Endocrinology, Montevideo, Uruguay. Dr. Buño will conduct research into certain problems in the field of primate embryology, and DR. LUIS VARGAS FERNÁNDEZ, assistant head of the department of experimental medicine of the National Health Service, Santiago, Chile, who will carry on experimental studies in the field of endocrine pathology.

Also to further their work in endocrinology, the following fellows will come to the United States: DR. JOSÉ RIBEIRO DO VALLE, Professor in the São Paulo School of Medicine and assistant at the Butantan Institute; DR. AMÉRICO SANTIAGO ALBRIEUX MURDOCH, head of the section of endocrinology in the Institute of Endocrinology, Montevideo.

For work in biochemistry the following, both of whom are members of the staff of the Biological Institute of São Paulo, have been appointed: DR. MAURICIO ROCHA E SILVA, member of the staff, São Paulo Biological Institute, who will work at the Rockefeller Institute for Medical Research; DR. OTTO GUILHERME BIER, assistant chief, department of serology, São Paulo Biological Institute, who will make quantitative chemical studies of immunity phenomena in collaboration with Dr. Michael Heidelberger, at the College of Physicians and Surgeons, Columbia University, and DR. EFRÉN CARLOS DEL POZO, professor of physiology, National School of Biological Sciences, Mexico, will carry on studies of the electrical stimulation of muscle at the Harvard Medical School.

In engineering sciences the following fellowships were awarded: DR. AUGUSTO JOSÉ DURELLI, engineer, Buenos Aires, who will investigate the photoelastic method of determining stresses and the application of this method to practical problems in reinforced concrete design, at the Massachusetts Institute of Technology; and NABOR CARRILLO FLORES, professor of mathematics in the National University of Mexico, who will continue his studies of soil mechanics in its application to the construction of foundations of buildings and dams, at Harvard University.

For researches in physics two fellowships were awarded: DR. MARIO SCHENBERG, professor of physics, University of São Paulo, who will study the application of nuclear and atomic physics to astrophysics, and FACUNDO BUESO-SANLLEHÍ, professor of physics, University of Puerto Rico, who will continue his studies in the field of band spectra, with Professor Arthur H. Compton at the University of Chicago.

Three fellows will work on botanical problems: JUAN IGNACIO VALENCIA, of the Darwin Botanical Institute, Buenos Aires, who will continue his taxonomic and mor-

phological studies of South American forage plants in collaboration with Dr. Agnes Chase at the United States National Museum; AGESILAU ANTONIO BITANCOURT, subdirector of the São Paulo Biological Institute, who will make a study of the virus diseases of citrus and of fungus parasites on other economic plants, with Dr. H. S. Fawcett at the Citrus Experiment Station of the University of California, Riverside, and with scholars in the U. S. Department of Agriculture, and EDGARD DO AMARAL GRANER, technical assistant in the Institute of Agronomy and lecturer in the "Luiz de Queiroz" School of Agriculture, Piracicaba, Brazil. His project is to study the citogenetics of corn and tobacco chiefly with Professor T. H. Goodspeed, at the University of California.

SPECIAL ARTICLES

THE ORIGIN OF THE RETE APPARATUS IN THE OPOSSUM

THE system of male genital ducts in vertebrates is mainly derived from mesonephric structures, preserved and readapted to another function. The mesonephric duct and a number of anterior tubules become the ductus deferens and ductus epididymidis, and the epididymal tubules, respectively; while connection with the gonad is established by means of the rete elements, which occupy an intermediate position at the hilum. These elements typically anastomose freely in the hilar region but connect as discrete ductules with the prospective epididymal tubules at the glomerular capsules.

While there is agreement as to the development of ductus deferens and epididymis, the problem of the origin of the rete apparatus has received many answers. Historically, it has been derived, according to different studies, from (1) cord-like outgrowths of the glomerular capsules which penetrate the hilum of the gonad to unite with the medullary cords; (2) conversely, by extensions of the medullary cords through the mesorchium to unite with the capsules; (3) as an independent, local development at the hilum, with connections established secondarily in both directions. Considering the diversity of forms studied, the differences of opinion are not surprising. The extensive literature is best approached through the medium of recent general discussions.[1, 2, 3]

In *mammals* the problem is complicated by the rudimentary nature and transitory development of certain of the structures involved. Consequently, if we accept for the purpose of this discussion the prevailing view that the rete apparatus has an independent origin locally, we still encounter widely different opinions as to the nature and precise manner of origin of the earliest visible primordia. One view of doubtful value holds merely, (*a*) that the rete connections arise as local condensations from the primary mesenchyme; a second (*b*) derives them from an ill-organized cellular blastema, probably originating from the adjacent coelomic epithelium;[4, 5, 6, 7, 8] while a third opinion (*c*) asserts a highly specific origin from discrete epithelial cords (sometimes tubular ingrowths) arising from the coelomic epithelium of the anterior genital ridge.[4, 9, 10, 11] In the last category, the resemblance which these structures bear to abortive nephrostomes or nephrostomial canals is frequently noted and discussed; however, only one author without hesitation describes them as such.[10] If this interpretation is correct there is a considerable accumulation of evidence from a number of mammals placing this group in line with a condition clearly established in certain lower vertebrates.[12, 13] This view would also identify the rete system with other parts of the male duct system, as a transformed mesonephric structure.

Much the same problem exists regarding the origin of the Mullerian duct, in particular the ostial ingrowth. In selachians this duct is still held to arise by a gradual backward splitting of the Wolffian duct, but in higher classes it develops by invagination of a localized area of ciliated coelomic epithelium at the anterior pole of the mesonephros. The ostium thus formed gives rise to the remainder of the duct by backward growth. The invaginating epithelium has been frequently, if rather loosely, identified with one or more mesonephric (or pronephric) nephrostomes.[2, 3, 4]

In view of the interest attaching to these structures, from the standpoint of comparative morphology as well as embryology, their development in the North American opossum (*Didelphys virginiana*), a primitive type of marsupial, deserves description. The process is similar to that described by Fraser[11] for certain Australian marsupials (especially *Trichosurus*),

[1] B. H. Willier, "Sex and Internal Secretions," 2nd Ed. Baltimore: Williams and Wilkins, 1939.
[2] F. W. R. Brambell, "The Development of Sex in Vertebrates," London: Sidgwick and Jackson, Ltd., 1930.
[3] E. S. Goodrich, "Studies on the Structure and Development of Vertebrates," London: Macmillan, 1930.
[4] S. E. Wichmann, *Anat. Hefte*, 45: 629, 1912.
[5] W. Felix, Keibel and Mall, "Manual of Human Embryology," II, Phila.: Lippincott, 1912.
[6] H. M. de Burlet and H. S. de Ruiter, *Anat. Hefte*, 59: 321, 1921.
[7] C. S. Simkins, *Acta Zool.*, 4: 241, 1923.
[8] K. W. Wilson, *Contr. Emb. Carnegie Inst. Wash.*, 17: 69, 1926.
[9] B. M. Allen, *Am. Jour. Anat.*, 3: 89, 1904.
[10] F. W. R. Brambell, *Proc. Roy. Soc.*, Series B, 102: 206, 1928.
[11] E. A. Fraser, *Jour. Anat.*, 53: 97, 1919.
[12] A. Brachet, "Traité d'Embryologie des Vertébrés," Paris, 1921.
[13] B. M. Allen, *Am. Jour. Anat.*, 5: 79, 1905.