Influence of Engineering upon Civilization will be held when the remaining nine national monographs will be presented. There will be an address summarizing "Fifty Years of Mechanical Engineering in the United States." At noon a luncheon will be given in honor of the founders of the society and this will be followed by the ceremonies attendant upon the presentation of medals of distinction.

Fiftieth Anniversary Medals will be conferred upon the sixteen men who present the monographs. The formal presentation will be made in each case by the Ambassador in Washington of the country sending the delegate. This occasion has been deemed unusually appropriate for the presentation of four other medals—the American Society of Mechanical Engineers, the Gantt, the Melville and the Guggenheim, to William Leroy Emmet, Fred J. Miller, Joseph Wickersham Roe and Orville Wright, respectively. This particular part of the exercises will be in charge of Dr. Arthur M. Greene, Jr., dean of engineering at Princeton University.

At a formal dinner on Tuesday evening at which Dr. W. F. Durand, past-president of the society, will preside as toastmaster, there will be addresses by the president of The American Society of Mechanical Engineers, and by Dr. Robert A. Millikan, past-president of the American Association for the Advancement of Science. There will also be an address by a distinguished American that may include, from an international view-point, an evaluation of the influence of engineering in promoting international amity and upon the progress of mankind.

On Wednesday, April 9, the delegates will visit points of interest in Washington and vicinity.

The announcement and first presentation will be made of the Herbert Hoover Medal by the Hoover Medal Board representing the A. S. C. E., the A. I. M. E., the A. S. M. E. and the A. I. E. E.

SCIENTIFIC NOTES AND NEWS

MR. JOHN W. DAVIS, formerly United States Ambassador to Great Britain, will preside at a dinner of the American Philosophical Society to be held in New York on April 2 under the auspices of the New York members of the society. The speakers will be Sir Robert Falconer, president of the University of Toronto; Dr. Livingston Farrand, president of Cornell University; Roland S. Morris, formerly ambassador to Japan.

PROFESSOR ALBERT A. MICHELSON has returned to the University of Chicago, his health much improved after two months spent in Bermuda. He intends to remain at Chicago for several months, working in the Ryerson Physical Laboratory, and then plans to go to California to continue his measurements of the velocity of light in a mile-long vacuum tube.

DR. KARL LANDSTEINER, a member of the Rockefeller Institute for Medical Research, New York, was awarded on March 14, the anniversary of Ehrlich's birth, the Paul Ehrlich gold medal of the Paul Ehrlich Foundation of Frankfort-on-the-Main, in recognition of his work on human blood groups and his hapten theory of immunity.

DR. ROBERT DOERR, professor of hygiene at Basle, has been awarded the Josef Schneider gold medal by the University of Wurzburg.

THE *Journal* of the American Medical Association reports that Professor Carlo Comba, director of the pediatric clinic of Florence, was the recipient of special honors on the twenty-fifth anniversary of his teaching activities. Professor Fiore presented his former teacher with a volume of scientific articles published for the occasion. Professor Comba has given the university 100,000 lire ($5,263) for a research fellowship in pediatrics.

WE learn from *Nature* that at a meeting of the Royal Society of Edinburgh, held on March 3, the following were elected fellows: Professor William Annan, Edinburgh; Mr. D. R. R. Burt, Colombo; Lieutenant-Colonel John Cunningham, Edinburgh; Lieutenant-Colonel L. M. Davies, Edinburgh; Dr. A. E. M. Geddes, Aberdeen; Dr. Douglas Guthrie, Edinburgh; Sir Thomas Holland, Edinburgh; Dr. David Jack, St. Andrews; Dr. S. G. Jones, Glasgow; Professor P. S. Lelean, Edinburgh; Dr. J. W. Low, Bristol; Dr. A. C. M'Candlish, Sorbie; Mr. W. C. Miller, Edinburgh; Dr. J. M. W. Morison, Edinburgh; Mr. James Morton, Edinburgh; Professor Wm. Oliver, Edinburgh; Principal G. F. O'Riordan, London; Mr. A. W. Ritchie, Edinburgh; Dr. David Russell, Leven; Dr. F. W. Sansome, London; Mr. E. C. Shankland, London; Dr. R. H. Slater, Edinburgh; Mr. J. W. Struthers, Edinburgh; Professor C. W. Stump, Sydney; Dr. J. D. Sutherland, Edinburgh; Dr. C. I. B. Voge, Edinburgh, and Dr. A. C. White, Beckenham.

SIR THOMAS H. HOLLAND, vice-chancellor of the University of Edinburgh, has been awarded the Gold Medal of the Institution of Mining and Metallurgy "in recognition of his eminent services to geological science and to the mineral industries during his tenure of high public appointments—notably those of director of the Geological Survey of India and of rector of the Imperial College of Science and Tech-

nology—and of his researches and publications upon the mineral resources of the British Empire and their relationship to national and international problems."

DR. WILLIAM J. ROBBINS, professor of botany in the University of Missouri, who has been on leave of absence working for the Rockefeller Foundation, Paris, has been appointed dean of the graduate faculty to succeed Dr. Walter Miller.

DR. F. L. STEVENS, professor of plant pathology of the University of Illinois, has accepted the first year incumbency of the newly established Baker professorship in the College of Agriculture, University of the Philippines. He will leave the University of Illinois on May 26, going directly to Manila. After the close of his work there, he plans to collect in the neighborhood of the Malay Archipelago and of the South Seas, especially in Siam, Sumatra, Java, Bali, Rarotonga and Tahiti, returning to the University of Illinois in September, 1931.

DR. J. W. SHIPLEY, associate professor of chemistry in the University of Manitoba, has been appointed professor of chemistry and head of the department in the University of Alberta. The appointment followed the retirement, due to illness, of Dr. A. L. F. Lehmann, who has been in charge of the department since the organization of the university in 1907.

DR. WILLARD WYLIE SPENCER, a graduate of Yale University, has been appointed head of the department of philosophy and logic of Miami University. Dr. Spencer is to fill the position left vacant by the resignation of Dr. Daniel Robinson last year and at present held by Dr. E. E. Powell as acting head of the department.

MR. J. B. S. HALDANE has been elected Fullerian professor of physiology at the Royal Institution, London, in succession to Mr. Julian S. Huxley.

DR. M. A. RAINES has resigned his position with Carl Zeiss, Inc., New York City, to accept appointment as associate professor of botany at Howard University, Washington, D. C.

THE resignation is announced of Dr. Roger Griswold Perkins, professor of bacteriology and preventive medicine and head of the department of bacteriology and hygiene of the School of Medicine of Western Reserve University. Dr. Perkins desires to be liberated from university duties so that he may have more time for special studies. He will live at Wakefield, Rhode Island.

PROFESSOR C. W. WOODWORTH has leave of absence from the University of California in order to carry on work for the California Spray-Chemical Corporation.

L. W. STEPHENSON has resumed his work as chief of the section of coastal plain investigations in the U. S. Geological Survey after a four-month furlough for field work in Venezuela.

AN expedition led by Dr. Robert F. Griggs will be sent to Alaska by the National Geographic Society during the coming summer to study the changes caused by volcanic eruptions. The party will work over the territory around Katmai Volcano and the Valley of Ten Thousand Smokes, which Dr. Griggs discovered while leading the society's expedition of 1916.

A PARTY of scientific men and sportsmen has left New York City for Miami to join the new *Nourmahal,* Mr. Vincent Astor's 2,900-ton motor yacht, bound for Indefatigable Island, one of the least known of the Galapagos group. They intend to cut their way to the interior of the island, to which no exploring expeditions have penetrated, and expect to find new species of animal and plant life. Accompanying Mr. Astor will be Dr. Eugene H. Pool, of the New York Hospital; Clarence L. Hay, of the American Museum of Natural History; Kermit Roosevelt, C. Suydam Cutting, Robert D. Huntington, Dr. James P. Chapin, ornithologist, of the American Museum of Natural History; Dr. Henry K. Svenson, of the Brooklyn Botanical Garden; Elwin R. Sanborn, photographer, of the New York Zoological Society; Wilfred S. Bronson, artist, and Dr. Charles H. Townsend, director of the New York Aquarium, who will be scientific director of the expedition. The trip originally was planned as a pleasure cruise. Then, interested in the peculiar natural characteristics of the Galapagos Islands, Mr. Astor invited Dr. Townsend to recruit a group of scientific men for the expedition.

DR. WILLIAM J. MAYO, of the Mayo Foundation, will deliver the first Stuart McGuire Lecture at the Medical College of Virginia, Richmond, on May 12. This lectureship has been established in recognition of Dr. Stuart McGuire's presidency of the college, from which he retired in 1925. The general public as well as the profession will be invited to attend.

COLONEL BAILEY K. ASHFORD, of the University of Porto Rico, who has been chosen by the Association of Military Surgeons of the United States as the lecturer of the Kober Foundation for 1930, delivered a lecture on "Significance of Mycology in Tropical Medicine" on March 28 in Washington.

PROFESSOR L. CHARLES RAIFORD, professor of organic chemistry, Iowa State University, has been appointed visiting professor for the forthcoming summer session of Western Reserve University. Professor Raiford will offer two courses of lectures: the

one on "Organic Nitrogen Derivatives," the other one on "Type Reactions in Organic Chemistry."

DR. A. B. STOUT, director of laboratories, New York Botanic Garden, lectured on March 14 at the University of Pennsylvania on "Sterilities in Plants." On March 15 he addressed the Botanical Society of Pennsylvania on the subject of "Day Lilies."

DR. CHARLES R. STOCKARD, professor of anatomy at Cornell University Medical School, New York City, will deliver the Lane Medical Lectures for the year 1930 at the Stanford University Medical School, San Francisco, from May 5 to 9. The subjects of the separate lectures are: "Medical and Biological Aspects of Constitution"; "Germinal Constitution"; "Developmental Constitution"; "The Interplay of Inheritance and Environment in Constitution," and "Postnatal Reactions and Periodic Changes in Constitution." Dr. Stockard will also give a lecture at Stanford University on May 7 on "Structural Types in Animals and Men."

PROFESSOR CASWELL GRAVE, head of the department of zoology at Washington University, St. Louis, gave on March 14 and 15 the following lectures at Oberlin College: "Structural Mechanisms of Ascidian Larvae which may be Involved in the Control of Metamorphic Change" and "Acceleration of Processes Underlying Metamorphosis of Ascidian Larvae."

DR. FRANK B. JEWETT, vice-president of the American Telephone and Telegraph Company, gave the third Aldred Lecture in the present series at the Massachusetts Institute of Technology on February 14. He spoke on "What Industry Expects of the Graduate." The fourth lecture was given on March 14 by Major W. C. Gotshall, of New York City, on "Reflections of an Engineering Experience."

DR. KARL MEYER, director of the Hooper Foundation for Medical Research of the University of California, will give a series of lectures at the University of Washington next July, as one of a group of medical men contributing to a short course for practicing physicians of the State of Washington.

THE Honor Society of Gamma Sigma Delta and the seminars for agronomy and for botany at the Kansas State Agricultural College were addressed by Dr. Edgar T. Wherry on March 11, 12 and 13.

LECTURES under the auspices of local chapters of Delta Omega, the honorary public health society, were given in March at the Massachusetts Institute of Technology and the Yale School of Medicine. At the third annual Delta Omega lecture at the Massachusetts Institute on March 4, Dr. C. C. Young, of the Michigan State Department of Health, national president of the society, spoke on "The Trend in the Development of Public Health Laboratories." The speaker at the second annual Delta Omega lecture at the Yale School of Medicine on March 14 was Dr. George H. Bigelow, State Commissioner of Public Health of Massachusetts, who discussed the official program for cancer control in his state.

DR. A. LANDÉ, of the University of Tübingen, now visiting professor of physics at the Ohio State University, gave a series of lectures on "Wave Mechanics" at the University of Kentucky on February 27 and 28.

PROFESSOR JULES DUESBERG, professor of anatomy and rector of the University of Liége, has accepted appointment as visiting professor from Belgium to the United States under the auspices of the C. R. B. Educational Foundation, Inc., 42 Broadway, New York. Professor Duesberg will lecture in English on biological subjects during January, February and March, 1931. During the war Professor Duesberg was connected with the Johns Hopkins Medical School.

PROFESSOR E. W. HEY GROVES, of the University of Bristol, delivered the Harveian Lecture before the Harveian Society of London on March 13. His lecture was entitled "Should Medicine be a Mendicant?"

PROFESSOR G. ELLIOT SMITH gave a lecture on "The Human Brain" at the Royal Society of Arts, London, on March 12.

AT the fourteenth annual meeting of the Pacific Division of the American Association for the Advancement of Science, to be held at Eugene, Oregon, from June 18 to 21, the Thursday evening address will be presented by Professor A. E. Douglass, of the University of Arizona. Dr. Douglass will discuss tree rings in relation to the history and ethnology of the southwest. His lecture will be illustrated by slides and motion pictures.

THE Pacific Section of the Botanical Society of America will hold its regular annual meeting in conjunction with the Pacific Division at the University of Oregon. Any botanist not a member of this division but who can attend these meetings is cordially invited to do so. Those desiring to give papers should notify the secretary of the botanical section, E. T. Bartholomew, Citrus Experiment Station, Riverside, California, not later than May 1, giving the title of the paper, the length of presentation time, and stating whether the use of a lantern is desired.

THE Ohio Academy of Science will hold its fortieth annual meeting at Ohio State University on Friday and Saturday, April 18 and 19, under the

presidency of Dr. F. C. Waite, of Western Reserve University. In general the program will follow that of other years, namely, a business session followed by a general scientific session in the forenoons, and sectional meetings in the afternoons, with a banquet followed by the presidential address on Friday evening. One interesting feature will be an illustrated lecture on "The Mound Builders—the First Ohioans," by Director H. C. Shetrone, followed by a personally conducted tour of the museum.

THE first meeting of the American Association of Physical Anthropologists will be held from April 17 to 19, at the University of Virginia, Charlottesville, coincidentally with the meeting held by the American Association of Anatomists. A program will be devoted to the subjects of mutual interest to the two societies. Detailed information concerning the objects and scope of the organization may be obtained from the chairman, Dr. Aleš Hrdlička, of the U. S. National Museum.

THE eighteenth annual meeting of the Eugenics Research Association will be held on Saturday morning (10:30), May 17, in New York City at the McAlpin Hotel. The day will be spent in eugenical programs, the morning being devoted to the Eugenics Research Association, the afternoon to the American Eugenics Society and the evening to the eugenics dinner, which will be the occasion for two short addresses on eugenical problems.

THE one hundred and sixty-third regular meeting of the American Physical Society will be held in Washington, on April 25 and 26. The Friday sessions will be held at the Bureau of Standards and the Saturday sessions at the National Academy Building. Those working on problems in "applied" physics are especially invited to report their researches at this meeting. It is planned to have at least one of the regular sessions on Friday devoted entirely to such papers.

THE date of the forthcoming congress of the International Society for Microbiology has been altered by the Central Committee in Paris to July 20 to 25.

THE fortieth anniversary of the Ecole de Psychologie of Paris, founded by Dr. Bérillon, was recently celebrated at a meeting attended by Professors Richet, Pierre Janet, Roux, Menetrier and Marcel Labbé.

THE will of the late William H. Nichols, chairman of the Board of the Allied Chemical and Dye Corporation, bequeaths $1,000,000 to public purposes. Half of the residuary estate is left to New York University for the maintenance of the Nichols Chemical Laboratory, which Mr. Nichols gave to the institution in 1927. He served as acting chancellor of the university last spring and fall during the illness of Chancellor Brown. It is requested that the bequest be used to keep the laboratory "at all times in good order and repair and well equipped." The largest institutional legacy is $250,000 to the Polytechnic Institute of Brooklyn. Mr. Nichols attended that school for three years in his youth and was vice-chairman of its board. The American Chemical Society and the American Society for the Control of Cancer each receive $50,000.

PRINCETON UNIVERSITY will receive a trust fund of $1,165,212, representing one half of the residuary estate of William Burhans Isham. The university will also receive a remainder interest amounting to $95,139 in the residence of the testator and a chest of silver valued at $2,500.

BEQUESTS received by De Pauw University during the past two weeks include a legacy of $200,000 for a chair of philosophy from James Nelson, of Indianapolis; the bulk of the estate of John H. Harrison, of Danville, Illinois, valued at between one and two million dollars, and approximately $150,000 from the estate of Marion B. Stultz, late trustee of the university, who named De Pauw residuary legatee in his will after giving his wife a life interest in his estate.

THE American Museum of Natural History receives $557,361 under the will of Frederick G. Voss. The bequest is to be used in the further development of research in anthropology and archeology.

THE University of London has received a bequest by the late Lady Durning-Lawrence of £10,000, for the equipment of the physical and electrical chemistry laboratory at University College.

FORMER SENATOR GEORGE WHARTON PEPPER will head a committee of the Benjamin Franklin Memorial, Incorporated, in a campaign to raise a fund of $5,000,000 for the erection of a science museum and memorial to Franklin on the Parkway, Philadelphia.

THE House has passed a bill (H. J. Res. 210) authorizing an appropriation of $15,000 for the expenses of official delegates of the United States to the World's Fourth Poultry Congress, to be held in England from July 22 to 30. Funds had previously been appropriated for a United States Government exhibit. The Office of Motion Pictures of the Extension Service of the U. S. Department of Agriculture is making a series of eight poultry motion-picture films for the exposition. Two of the eight have been finished though not yet released—The Turkey Business and Breeding for More and Bigger Eggs; three are in production—The Egg Marketing of the United States, The Poultry Marketing Industry of the

United States and Cooperative Marketing—Eggs and Poultry, and films on which scenario work has been done, but on which production has not started, are Brooding and Rearing Chicks, Eradication of Poultry Parasites and Rearing Chicks in Confinement.

IT is stated in *Nature* that the International Union for Pure and Applied Chemistry has now been reconstituted and brings in the German chemical societies under mutually acceptable conditions. Before this could be accomplished, it was necessary for three of the leading German chemical societies to form a joint committee for international occasions. This Verband Deutscher Chemischer Vereine has been able to negotiate with the Union Internationale de la Chimie Pure et Appliquée. The new constitution and statutes are given in an article by Professor Haber, president of the Verband D. C. V. in the *Zeitschrift für Angewandte Chemie*. The new title is to be Union Internationale de Chimie, omitting the words pure and applied. The new statutes were agreed upon at Scheveningen in June, 1929. German adhesion to the reconstituted union is subject to the understanding that in its new constitution the International Research Council will not hinder the autonomy and free development of the union.

THE London *Times* reports that the British Association for the Advancement of Science has been summoned at Bromley (Kent) for the non-payment of rates on Downe House, Charles Darwin's old home. Mr. Weller, who appeared for the Bromley Rural District Council, said that points of law were involved and counsel had been instructed on both sides. The case was adjourned. Downe House was presented to the British Association by Mr. Buckston Browne as a national memorial to the great naturalist, and was opened last June by Sir Arthur Keith.

ARRANGEMENTS are being considered by which graduate students in meteorology at the Massachusetts Institute of Technology may be sent to the University of California Scripps Institution of Oceanography at La Jolla, California, to acquire additional knowledge of the subject.

THE Frederick H. Rawson-Field Museum Ethnological Expedition to West Africa has completed its work in Angola (Portuguese West Africa) and Nigeria (British West Africa), and is returning with extensive collections. The expedition, under the leadership of Assistant Curator W. D. Hambly, has collected large amounts both of exhibition and study material representing many tribes of which little scientific knowledge had previously been available. In addition to collecting artifacts, the expedition made still and motion pictures of natives engaged in many occupations, took dictaphone records of their languages and collected various other data for scientific reports. The Chancellor-Stuart-Field Museum Expedition to the South Pacific has also returned with important collections for the department of zoology. The expedition worked in Australia and New Zealand as well as in the Dutch East Indies. Philip M. Chancellor, of Santa Barbara, California, was both sponsor and leader of the expedition. Associated with him as coleader was Norton Stuart, naturalist, also of Santa Barbara.

THE British government has decided to more than double the allocation of funds for forestry extensions for the second period of ten years under the national afforestation scheme. For the first ten years a sum of £3,500,000 was allotted, with the help of which an area of 164,000 acres will have been planted by the end of this year. In addition to this, some 70,000 acres have been planted by private landowners and local authorities. The planting of this area has meant the employment of about 3,500 men in winter and 2,500 in summer. Nearly 700 small holdings have been established providing all-the-year-round work for that number of families. These family holdings also mean the growing up of a class of skilled forest workers. Forest work for 150 days in the year is guaranteed, while for the remainder the forester is allowed to work on his own 10-acre holding.

THE Radium Commission, London, announces, according to the *Journal* of the American Medical Association, that the 4-gm "bomb" has been received from Belgium and, after being measured and tested in the National Physical Laboratory, it was handed over to the Westminster Hospital, where arrangements for its installation and manipulation and the treatment of patients had already been made. If at the end of three months the National Radium Trust decides to purchase the radium composing the bomb, it will be entrusted to the hospital for a further period of three years at a rental of $2,000 a year, and the hospital will maintain a continuous day and night service with the bomb, in the pursuit of objectives prescribed by the commission. The commission has decided to recognize as national radium centers only such places as possess medical schools with complete clinical courses and facilities for giving instruction in radium therapy. The commission believes that the need for trained workers is even more urgent than the supply of radium itself. It will initiate all negotiations for the constitution and equipment of national radium centers through the medical faculties of the local universities concerned. When the respective claims and requirements of the

various radium centers have been considered and assessed by the commission, the allocation of national supplies of radium will be commenced. Orders have already been placed by the trust for 10 gm exclusive of the 4-gm bomb, and it is anticipated that the whole of this should be available before the autumn of 1930. It has been decided to install a radon plant at the National Physical Laboratory for the purpose of supplying (under proper safeguards) radon to hospitals or other institutions which otherwise could receive no direct assistance from the commission for radium therapy.

DISCUSSION

ENVELOPING MEMBRANES OF ECHINODERM OVA

THE fertilization membrane of Echinoderm ova has been made a subject of discussion in two recent communications to SCIENCE, one by A. R. Moore, "The Function of the Fertilization Membrane in the Development of the Larva of the Sea Urchin,"[1] and the other by E. E. Just, "The 'Fertilization' Membrane of Echinid Ova."[2]

The former is a statement of certain facts from which a rather sweeping conclusion is drawn, while the second cites observations on one kind of ovum to refute the conclusion of the former dealing with another kind of ovum.

Moore, using the ova of *Strongylocentrotus purpuratus,* found that eggs treated with urea and subsequently fertilized form no fertilization membranes, and when segmentation sets in the blastomeres fall apart. He concluded that membrane formation (by which he evidently means the fertilization membrane) is of fundamental importance to the development of organisms consisting of closely associated groups of cells. He should have restricted this conclusion to urea-treated Strongylocentrotus eggs.

It is to be deplored that Just makes no mention of the species on which he bases his conclusions. Presumably he has reference to the Woods Hole Echinids *Arbacia punctulata* and *Echinarachnius parma.* In addition to using data of his own on the removal of the fertilization membrane Just gives credit, albeit dubiously, to the micro-dissection method by means of which the vitelline membrane has been removed from the uninseminated eggs of both these species.[3] Such eggs, when subsequently fertilized, segment and develop into normal embryos with no fertilization membranes.

Hence, both investigators are correct if only they had restricted their divergent conclusions to the particular species with which they worked; namely, when the Strongylocentrotus ovum is divested of its fertilization membrane by means of urea its blastomeres do not hold together to develop into an embryo, while the Arbacia and Echinarachnius eggs, on the other hand, are fully capable of normal development without fertilization membranes.

I have not worked with the Strongylocentrotus egg, but from Moore's observation I judge that it closely resembles the Woods Hole Asterias egg in regard to the cohesive properties of the blastomeres. In the Asterias egg the early blastomeres are loosely distributed within the fertilization membrane and only by careful observation can one detect a delicate, secondary membrane, investing the outer borders of the blastomeres and extending between them. This membrane, which develops on the surface of the egg several minutes after the fertilization membrane is lifted off, is too weak to hold the blastomeres together so that they would fall apart if it were not for the externally investing fertilization membrane. Moreover, this secondary membrane is formed only when a bivalent electrolyte (Ca or Mg) is present in the surrounding medium.

In the Arbacia and Echinarachnius egg a similar secondary membrane is formed, the so-called hyaline plasma layer, and it is strong enough to hold the blastomeres firmly together without the aid of the fertilization mebrane. This secondary membrane can be torn with micro-needles, in which case the blastomeres fall apart.[4] This and the fertilization membrane constitute the anatomical structures (quite apart from the true plasma membrane of each individual cell) which Moore rightly concludes are necessary to permit normal development by keeping the cells closely associated.

ROBERT CHAMBERS
NEW YORK UNIVERSITY

THE ELECTRON AND RADIATION

THE electron has been shown[1] in several ways by me to possess certain fundamental properties. It is of course desirable that this result should be obtained in as many ways as possible, and one more will therefore be given here.

Consider a closed chamber with perfectly reflecting walls whose total mass is infinitely large so that they may withstand any pressure. Suppose that the chamber contains a single free electron, and a par-

[1] 70: 360, October 11, 1929.
[2] 71: 243, February 28, 1930.
[3] Chambers, *Biol. Bul.,* 41: 318, 1921.
[4] *Anat. Rec.,* 25: 121, 1923.
[1] *Phil. Mag.,* 7: 493, 1929; SCIENCE, 70 (1820): 479, 1929.