Meetings

Radioactive Dating and Low-Level Counting

The study of radioactive dating and methods of low-level counting were the subjects of a symposium, organized by the International Atomic Energy Authority in conjunction with the Joint Commission for Applied Radioactivity (ICSU) and held at the Palais des Congres, Monte Carlo (2–10 March 1967). Four distinct, but related, areas of interest were discussed: geochemistry and cosmochemistry of radiocarbon and other isotopes and their application to dating problems; the study of meteorites; methods of dating by primeval isotopes; and a discussion of techniques of measurement and low-level counting.

Pioneer work by W. F. Libby culminated in the use of radiocarbon for absolute dating. He recounted in his opening review paper the many problems involved in developing this technique and asserted that, at several crucial stages, luck played an important part in making this first dating system viable. He related much information that could be useful to one constructing a new radiocarbon dating laboratory.

Several reports were made on investigations of the fundamentals of radiocarbon dating. Now that the techniques are much more precise, knowledge of the temporal variations of the concentration of carbon-14 in the atmosphere is of increasing importance in order that absolute dates may be calculated from activity measurements made in the laboratory. It is well established that the ages obtained on the assumption of constant, initial concentrations of radiocarbon in the specimens can differ by several hundreds of years from historical and dendrochronological dates for certain periods over the past 6000 years. H. E. Suess presented the latest determinations of of the fluctuation of radiocarbon concentration over the earlier half of this period, as adduced from the current activity of dendrochronologically dated growth rings of the Californian bristlecone pine (*Pinus aristata*). These data can be used to construct a calibration curve for radiocarbon dates. The carbon-14 concentration increases rather steadily during this time and an attempt to follow the trend further back in time was made in work described by M. Stuiver. He analyzed measurements of the rate of sedimentation in lakes, widely separated geographically, for synchronous events. Such events could be due to past, worldwide climatic changes or to changes of concentration of radiocarbon, as reflected in the calculated dates. These results confirm the change in carbon-14 concentration that occurred before 2500 years ago and indicate that the concentration increases at least during the past 10,000 years. This result is at variance with other correlations, such as the Swedish varve chronology which indicates that the carbon-14 concentration should, at about 8000 years ago, be similar to a value obtained in the 19th century A.D.

Reports were made on methods of determining various important nuclides in the study of meteorites. The Saint Séverin chondritic meteorite, which fell on 27 June 1966, was the subject of study for several groups of European investigators. The investigators discovered and measured the short-lived nuclides (Mn-52, V-48, Cr-51, Co-56, Mn-56, and Al-26), produced by cosmic radiation. The separation and measurement of the nuclides produced by fission and by cosmic radiation was possible by a study of the variation with depth of heavy ions in the ores together with the measurement of uranium concentration. This combination of studies by neutron activation, gamma spectroscopy, and mass spectrometry enabled a radiation age of 12 million years to be calculated for this meteorite.

Conflicting ages for meteorites are produced by the isotope ratio method of K-40 to K-41 and by the rare gas method. Fisher gave reasons for believing that space erosion was the factor mainly responsible for this, though long-term variation of cosmic flux might be a contributing factor. Data on 60 iron meteorites, obtained by the potassium isotopes ratio method, enabled Voshage to determine that these could have originated from three large iron-nickel masses which became disintegrated.

Although no new principles in the field of dating by primeval isotopes have evolved, several technical refinements have occurred, thus enabling more accurate and certainly more rapid determinations of ages. The most promising of these new techniques may stem from a chance observation by R. M. Walker, the originator of the "Fission Track" method of dating. Small etch pits, some three thousand times more numerous than the normal fission tracks, were observed upon careful development of a cleavage of mica. These tracks, presumed to be caused by a series of alpha-particle, recoil events are of the order of 100 angstrom units in length, and require observation by the electron microscope or scanning electron probe techniques. This will probably restrict the use of the method initially in comparison with normal fission track measurements which require light microscopy only. The method is easily calibrated. Despite the short time that has elapsed since the initial observation, Walker has been able to present a convincing, simple theory of the effect. Further results will be most interesting and there is promise of very high precision dating.

Two new designs of gas proportional counters have been developed at Oeschger's laboratory. One counter is specially designed for use in the search for argon-39 which would be produced by the flux of cosmic rays. It is constructed almost entirely from a plastic material shadowed with thin films of aluminum or gold. The films produce necessary electrical conductivity on the internal walls to give the particle accelerating field. This is surrounded by a guard counter constructed from similar materials.

A very low background activity is predicted for the counter. A novel, high-pressure counter for tritium contains over a hundred anodes. These are connected in four groups such that each wire is surrounded only by wires belonging to the other groups. Owing to the short range of electrons from the tritium decay, only one group should produce a signal. The other groups act

as an internal anticoincidence system. Difficulties with end effects and electronegative impurities should be overcome by this unique system.

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Biomacromolecules: Views and Models

A symposium entitled "Views and Models of Biomacromolecules" was held 15 May 1967 at the New York University Medical Center, New York City. A. K. Kleinschmidt (New York University School of Medicine) discussed the techniques used to determine the size and configuration of nucleic acid strands when removed from the core of different virus particles. The basic techniques consisted of extracting and letting the nucleic acids absorb from a solution to a protein monolayer, either by spreading a protein-nucleic acid mixture, or by utilizing the undisturbed diffusion of the filamentous macromolecules to a preformed absorptive stable film. Extraction of viral nucleic acids in various ways and originating the film can be performed in one step, so that the results show lengths of nucleic acids per virus particle. This was shown mainly with reovirus RNA extracted by urea. These nucleic acids have a tendency to fall apart in short pieces of trimodal size. DNA from many viruses was found in one filament that fit the lengths calculated from the known data of molecular weight. The shape predicted from models in solution was assumed to be transferable to electron micrographs. Measurements of length and end-to-end distances have been used to determine the spatial arrangement. Emma Shelton (National Cancer Institute) discussed the appearance of ribosomes in both monomeric and polymeric states. Using plasma cell ribosomes from neoplastic mice as the experimental material, the development of polyribosomes was traced. The differing degrees of coiling of free and membrane-bound polyribosomes were attributed to the intermolecular forces involved in attachment. Ribosomes polymerize; their smaller subunits bound to the extended messenger RNA give rise to a helical array of polyribosomes. The possibility of the pathway of messenger RNA between the large and small subunits as well as models for the possible method of transfer RNA and polypeptide formation were discussed. Morris J. Karnovsky (Harvard Medical School) demonstrated the use of peroxidases as tracers in the movement of macromolecules through cellular structures. By electron microscopy and measurements of the widths of cell unit membranes, as well as the tracer techniques, it was shown that the vascular channels in endothelial brain cells of rat and mouse were actually open when a small enough tracer was used. The peroxidase tracer and lanthanum nitrate were also used to demonstrate that, in mice, a barrier between blood and brain does exist. The cellular pores are closed between the chorioplexus and the nervous tissue; this may be demonstrated in both directions. Some further experiments to show the reactions of enzymes in muscle T-bands were illustrated with excellent micrographs.

Roderic Park (University of California, Berkeley) discussed the interpretation of cleaved membranes in chloroplasts. The use of freeze-etching and freeze-fracture techniques indicated that the fracture planes are most likely in the lipid layers between the grana. This interpretation is at variance with other workers in Zurich. The interpretation of electron micrographs of freeze-fractured surfaces has become a growing feature of electron microscopic research. It presents views of ultrastructure split at minimum interfacial tension, which varies considerably from previous methods of sample preparation. A very convincing model of chloroplast layers and structures was described and defended by Park. E. Kellenberger (Université de Genève) described experiments with mutants of bacteriophage T4 of *Escherichia coli* which were designed to reveal certain morphological features relating to their positions along the genetic map. The organized T4-phage head and its proteins of double-mutants were identified by electron microscopy and acrylamide gel techniques, combined with the localization of the genes responsible for the morphopoiesis of the phage heads. Some mutants had features which could be used to relate the specific genes responsible for the head formation of the T4 phage, either as a regular, or a prolate icosahedron. Considerable effort has gone into the examination of many mutant T4 strains, to determine precisely which morphological features are the results of the deletion, inclusion, or recombination of specific genes. S. S. Breese, Jr. (Plum Island Animal Disease Laboratory) presented material on the virus of foot-and-mouth disease as a macromolecule. Methods by which physical constants such as sedimentation and diffusion could be determined on impure but infectious samples were discussed. Examples were shown of the formation of crystalline arrays of virus in tissue culture cells and determination of the electron microscopic substructure of the virus. The difficulties of this virus as an experimental model as well as its advantages were pointed out.

The symposium was held under the auspices of the New York Society of Electron Microscopists and the New York University School of Medicine.

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Cellular Dynamics

The fifth conference on cellular dynamics was held at Princeton, New Jersey, 8–11 January 1967. Representatives of many disciplines—medical, biological, and biochemical—convened for a reevaluation, in the light of recent progress in those disciplines, of aging in cells and cell strains. On the assumption that such aging does take place, it was expected that the relation of these processes to more familiar manifestations of the syndrome in whole animals would be examined.

The sessions, arranged by M. D. Rosenberg, were broadly based in the several fields of clinical and biological research from which solutions to problems of aging must eventually flow. The argument that aging of animals is a reflection of aging in cells was reviewed by B. L. Strehler, who described the several classes of hypothesis currently held, and offered a speculative one of his own.

Some populations of fixed, postmitotic cells in the mammalian body show losses in number correlated with the other manifestations of aging. Even those populations for which a decrease in numbers cannot be demonstrated may show age-related loss in functional capacity. However, some cell populations and tissues showing no loss in basal function have, in age, a demonstrably reduced capacity to respond to stress.