samples large enough for most physical measurements. By means of Rupprecht's technique, films of arbitrary size and thickness can be formed; adjacent threads agglomerate while dyring and form a homogeneous material.

Rupprecht has since refined his method, and samples of oriented DNA have served in a range of studies of potential importance for a better understanding of the genetic material and for verification of quantum chemical theories. Rupprecht's preoccupation has been with the orientation technique; most of the physicochemical studies are being made in cooperation with other specialists.

Conductivity (d-c) measurements on dried oriented DNA have shown semiconductor characteristics of the DNA helix, such as were postulated by A. Szent-Györgyi, and, in agreement with results from unoriented DNA, reported by several other investigators. However, there is no marked anisotropy in the conductivity of the oriented DNA; Rupprecht attributes this negative result to structural changes that occur in the DNA during drying.

Using moist films for studies of hydration of DNA, Rupprecht has found a dependence of the proton magnetic resonance signal on the orientation of the DNA helices in relation to the magnetic field. The result is strikingly similar to that obtained for collagen by H. J. C. Berendsen of Gröningen, who explained the effect by postulating chains of water molecules in parallel alignment with the collagen fibers. Rupprecht and Berendsen's group plan to cooperate in further work in the oriented DNA. At the Medicinska Nobelinstitutet in Stockholm, A. Ehrenberg has begun studying electron spin resonance in moist oriented DNA samples that have been frozen, and afterward irradiated with gamma rays from a cobalt-60 source. He, too, has found marked dependence of amplitude on the orientation of the DNA helices in the magnetic field. So far, identification of thymine radicals has been reported, and the work is continuing with DNA moistened with heavy water (D_2O), in the expectation that other radicals will be identifiable and that the mechanism of their formation by irradiation may be elucidated.

Measurements of the mechanical properties of the oriented DNA threads and films, and their dependence on spinning conditions, provide Rupprecht with a basis for systematic development of his technique. He has found that the tensile strength of the fibers are markedly dependent on temperature. At present he is engaged in developing thin fibers for high-resolution x-ray diffraction studies, and thin films for use in research on the optical properties of oriented DNA.

A final example of the techniques originating in Hedén's group is E. A. Falch's "one-dimensional" culture for automatic screening of microorganisms. He uses a strip of newly solidified agar containing various nutrients and inoculated along its length with bacteria. The agar is carried into an incubator on a moving surface—a polypropylene belt in the original tests. Zones of growth or inhibition can be detected optically when the agar emerges from the incubator. The uses envisaged range from labor-saving selection of microbial strains that synthesize a particular compound, to automatic identification of microorganisms. The technique was first demonstrated in 1965, but it still awaits full development.

Requests from other laboratories for various items of equipment developed by the Karolinska bioengineering group overtaxed their workshop. In 1966, a company, Biotec, was created to manufacture some of the specialized equipment developed by Hedén and his group. The company has been successful and has established branches in the United States, Britain, and Japan. Biotec, is, incidentally, one of the companies sponsored by Incentive AB, a new Swedish financial enterprise dedicated to encouragement of new industry, with emphasis on science-based activities.

The Project for Applied Microbiology, within the scope indicated at the outset, will be concerned with trouble-shooting and *ad hoc* research for industrial clients, and also with long-term research on its initiative. As an example of a long-term project, it will take over work, already in progress in the bioengineering group, on culture of methane-fermenting bacteria as a potential source of protein-rich food. Fast-growing strains and appropriate media have been found, but the principal bioengineering problem is one of gas transfer—of oxygen as well as of methane—to the culture. Algal species may have earlier application, if problems of harvesting and food technology can be solved. Hedén is particularly interested in *Spirulina*, "discovered" by Belgian and French microbiologists as an algal species that Africans in Chad have eaten for centuries. *Spirulina* is particularly easy to harvest because the helical form of the alga tangles the crop into strong mats. One of the first activities of the project will be to convene a meeting on *Spirulina* cultivation to help establish a coordinated research program in this area.

Hedén was the instigator of two conferences on Global Impacts of Applied Microbiology, the first in Stockholm in 1963 and the second in Addis Ababa in 1967. The conferences were convened to draw attention to microbiological needs of the developing countries. The international outlook of the Project for Applied Microbiology is best illustrated by the so-called BIORED scheme (biological resources development teams), which will become its responsibility. This scheme was first proposed by the bioengineering group in 1965 as a contribution to the International Biological Program. A feasibility study, in Ethiopia last year, indicated the form which the first of such operations might take (a base laboratory and a mobile unit in a 2-ton truck) and disclosed a range of local studies of practical importance in Ethiopia. At present the scheme is waiting for the necessary arrangement between the Swedish and Ethiopian governments.—NIGEL CALDER

RECENT DEATHS

Louis G. Austin, 54; professor of biology, Virginia State College, Norfolk; 29 February.

John M. Boutwell, 93; former president of Society of Economic Geologists; 2 March.

George E. Boxer, 53; executive director of the Merck Institute for Therapeutic Research; 14 March.

L. Beverley Chaney, 77; retired clinical professor of neurology, Columbia University College of Physicians and Surgeons; 12 March.

Herbert G. Deignan, 61; ornithologist emeritus and honorary research associate of the vertebrate zoology section, Smithsonian Institution; 15 March.

McKay Donkin, 63; vice president for finance and treasurer of Pennsylvania State University; 17 March.

Rudolph E. Langer, 74; chairman emeritus of the mathematics department, University of Wisconsin, and former director of the U.S. Army Mathematics Research Center; 12 March.