of commodities by pipeline, new techniques of the temperature control of perishable goods in transport and storage applicable to the less-developed areas, and the implications of present scientific research for transport in the future. Papers in Vol. 6, which tackles health and nutrition, are arranged under: planning for health services; the control of diseases; and research and planning (including papers on the provision of facilities for medical research and its future organization and on the role of medical research in less-developed areas. Those in Vol. 7 on social problems of development and urbanization include one on patterns of world-wide cultural change in the 1960's and others on a theory of community development, the implications of urbanization and the role of the family in industrialization. Papers in Vol. 8, on organization, planning and programming for economic development, are grouped under: the methodology of development planning; techniques used; and implementation of development planning.

Vol. 9, covering scientific and technological policy, planning and organization, is of rather more general scientific interest and includes three papers (one by Dr. J. R. Killian, jun.) on issues of policy and planning (including one on the loss of scientists from less- to more-

developed countries), followed by three on instruments of scientific and technological policies, such as the role of a research institute, of the national laboratory, and on agricultural and industrial extension services to diffuse technological knowledge. The eight papers comprising Vol. 10 deal with international co-operation and problems of transfer and adaptation, and range from international culture, technical assistance, voluntary association and development to co-operation programmes for strengthening engineering education. Vol. 11, on human resources, is in two parts, the first covering human resources generally, including public management, management and skilled supervision and occupational safety. The second, dealing with training of scientific and technical personnel, has three papers in a section on planning policies for development of scientific and technological personnel, one of which discusses the programming of science and technology within the educational system, and seven in a section on programmes for educational development. Vol. 12, on communications, is arranged in four sections: unification and expansion through telecommunications; broadcasting and television in less-developed areas; development of national and international telecommunication networks; and telecommunications in specialized fields.

ELECTRON MICROSCOPY

THE electron microscope, since its first crude prototype thirty years ago, has transformed our notions of cytoplasm from that of a homogeneous colloidal system to that of an intricacy of precisely organized structures—mitochondria, plastids, ergastoplasm, Golgi bodies, neurofilaments, synaptic vesicles, and so on—each distinguished by a characteristic sub-microscopical architecture which has proved to be quite remarkably uniform throughout the animal and plant kingdoms. The Medical Department of the British Council recently issued an excellent collection of fourteen short thematic essays intended to provide, according to Dr. V. E. Cosslett in the introduction, “an interim assessment of the contribution the electron microscope is making in medical research”*.

Three excellent papers, respectively by M. A. Epstein, by A. F. Howatson and (jointly) by R. W. Horne and P. Wildy, survey and illustrate the ultra-structure of viruses, the last paper reviewing the use of negative-staining techniques in the elucidation of the molecular structure of viruses and phages. Valuable as these three papers on viruses are as special instances, they give an inadequate impression of the contribution being made by the electron microscope to what might be called the biology of virus infection—the sites of virus multiplication within cells, the time and manner of their release, and so on. Then the short review by Audrey Glauert on the fine structure of bacteria, and that by A. V. Grimstone on the ultra-structure of cilia and flagella, show how a new dimension, both scientific and aesthetic, is now being added to descriptive bacteriology, and the paper by R. C. Valentine shows how the electron microscope has been applied to estimate the viability of that most baffling of all pathogenic micro-organisms, the leprosy bacillus.

The study of tissue structure is exemplified in reviews by J. A. Chapman on collagen and fibrogenesis, on melanocytes by M. S. C. Birbeck, on the fine structure of endocrine cells by J. D. Lever, on the cytology of the organ of Corti in the inner ear by I. Friedmann, on testis structure and function by D. Lacy and on the cancer cell by E. H. Mercer. The nervous system is represented by an excellent paper by V. P. Whittaker and E. G. Gray on the synapse: their successful isolation of nerve endings in

good state of preservation, using the methods of sub-cellular fractionation, opens up exciting possibilities for the identification of hitherto unknown transmitter substances. The gains in the aforementioned fields of ‘straight’ morphology have been tremendous, and although much awaits us—particularly in the study of the pathological cell and cellular products—by such straightforward ultra-structural study, there are already intimations of new fields opening up by the use of specific electron stains for enzyme localization at the subcellular level, as exemplified in the paper here by S. J. Holt and R. M. Hicks.

This is a compilation of special themes by experts, mostly electron microscopists or cytologists, on their own subjects and is in no sense a text-book or monograph on electron microscopy in medical research. Therefore, in assessing the contribution of the electron microscope to medicine, we must supplement these papers in our own minds with the now almost innumerable details of normal and abnormal structure and function which the high resolution of the microscope has clarified—the nature of the ‘blood-brain-barrier’, the process of myelin sheath formation, the structure of the motor end-plate, the muscle fibre fine structure, the fine structure of the plasma cell and other cells involved in immunological processes, etc.; and, not least, its important role as monitor of cell fractionating methods used by the cell chemist.

Finally, as Dr. V. E. Cosslett says in the introduction, the chief remaining technical or physical problem of electron microscopy is that of examining living matter. The difficulty is that, to protect the living cell from exposure to vacuum, it must be exposed in a chamber with walls thick enough to prevent evaporation but thin enough to be penetrated by the electron beam. Even with a small bacterium the total thickness of the preparation can scarcely be less than 1 micron; a beam voltage of at least 500 kV is needed to penetrate this distance and still yield a reasonably clear electron picture. Such a high-voltage electron microscope has now been built at the University of Toulouse and the first micrographs of living bacteria have been published (Dupouy *et al.*, *C.R. Acad. Sci. (Paris)*, 251, 2836; 1960). We may be within sight of electron-beam time-lapse studies of cells in tissue culture.

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* *Electron Microscopy*. *British Medical Bulletin*, 18, No. 3, September 1962, Pp. 71 + ix. (London: The British Council, 65 Davies Street.) 35s.