pregnant and lactating rats" by Pierre C. Karli, "Delayed implantation in mammals" by Robert K. Enders, "Morphology and physiology of the uteroplacental circulation" by James Dixon Boyd, "Uteroplacental circulation in mammals" by C. Sidney Burwell, "Pressures in the fetal circulatory system of the sheep" by S. R. M. Reynolds, "Distribution of arteries and veins in the mammalian placenta" by Elizabeth M. Ramsey.

These conferences are especially interesting, because there are interruptions throughout each presentation. Furthermore, the discussions are spirited, provocative and frank. As Fremont-Smith says, "the tradition, now well established, that authority carries little weight in evaluating the credibility of ideas, concepts, and data, help to make the conference a forum for searching examination of differences of opinion and of the reasons for contradictory experimental results. Overgeneralizations are quickly met with the question 'with respect to what?' "

The discussion of Boyd's paper concerning the uteroplacental circulation was particularly interesting to me, but it is unfair to select any of the papers presented as being more worthwhile than the rest.

The book is a very important contribution on the subject of gestation. It is up-to-date and contains a vast amount of valuable information presented by experts in anatomy, biological chemistry, physiology, cancer, biology, psychobiology, zoology, embryology, and obstetrics and gynecology. It is a pleasure to read the book, not only for its stimulating contents, but also because the type is clear and the illustrations are well reproduced.

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Expanding Universes. E. Schrödinger. Cambridge University Press, Cambridge, 1956. 93 pp. 10 illus. $3.50.

This lucid series of lectures is concerned with the kinematics of particles and waves in an expanding universe. The first two chapters present an interesting exposition of the geometric properties of the de Sitter universe and general spherical spaces. Various representations of the de Sitter universe are compared. Properties of the geodesics and null geodesics and the meaning of the red shift of light waves are discussed. The other two chapters deal with a question that led historically to the development of wave mechanics—that is, the relationship between geometric optics, wave optics, and the Hamilton-Jacobi equation. The propagation of waves in an expanding universe and the concept of paths along geodesics are examined. The discussion follows largely some research work of the author that was published in the 1930's.

The book is distinguished throughout by its delightful clarity, its constant emphasis on geometric visualization and its unhurried style. This forms a pleasant contrast to the modern tendency of piling formalism on formalism, and one cannot help wondering whether our contact with physical intuition is not seriously obstructed by the modern trend in the style of writing.

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Engineering in History. Richard S. Kirby, Sidney Withington, Arthur B. Darling, and Frederick G. Kilgour. McGraw-Hill, New York, 1956. vii + 530 pp. Illus. $8.50.

History of American Technology. John W. Oliver. Ronald Press, New York, 1956. $6.50.

The stimulating history of engineering by Richard S. Kirby and his associates emphasizes at all times the close contacts between science and engineering. The initiation of novelty emerges, at times, in some practical application for which scientific analysis finally affords a generalized explanation, as in the case of the suction pump; at times, applications emerge from the prior establishment of a general principle, as Boyle's law led to an efficient use of steam. Keen perception of this association between science and engineering has made it possible for the authors to compress into a single volume an impressive history of the fields of civil engineering, construction, transportation, and power engineering.

The short chapters on Egypt, Greece, and Rome emphasize the dependence of ancient engineering on massed human labor, despite the emergence of two types of water wheel toward the close of the pre-Christian era. The generalized use of water and wind mills in the Middle Ages is characterized as a revolution in power, which laid the foundations of a new economy. The development of science, beginning with Leonardo da Vinci, freed engineering from the limitations of mere empiricism in the use of pressure media, making possible a further advance in the power economy.

The development of stone work is covered step by step from the Roman arch through the Gothic. In bridge design, the use of wood led to truss designs as early as Palladio, and this innovation, of course, came to have special significance when iron and steel became available. The history of steam transportation on land and water is remarkable for its compactness and comprehensiveness. The outstanding features of the later chapters are the account of the electric industries, the techniques of caisson work, tunneling shields, and suspension bridges.

Despite the wide range of material, the narrative has a structure that is vividly felt and moves with such vigor that it is hard to lay the book down. It is a fine achievement in historical writing.

The study of American technology by John W. Oliver is unusual because of the emphasis on the intimate relationships between science, technology, and culture. Although new discoveries in science and major inventions are fully appreciated, much attention is given to the diffusion of scientific and technical knowledge by scientific societies and to modifications of engineering practice. The narrative is divided into four periods: 1607–1789, 1789–1865, 1865–1900, and 1900 to the present. For each period, the technical features of production and communication are surveyed comprehensively. Agriculture and the processing of agricultural products is, therefore, an integral part of the narrative. Communication, too, is broadly conceived; it includes the development of the newspaper, printing, paper-making, and the whole sequence of electric inventions for the transmission of news and pictorial material.

Although all the topics in each period are fully covered, the arrangement is not stereotyped; hence, the characteristic problems of the different periods are not obscured by a rigid plan.

The development of the economy of the United States is portrayed with great skill and without undue emphasis on any single factor. The book is a notable contribution to the economic and cultural history of the United States and will be invaluable to the general reader and to college students.

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Yellow Fever Vaccination. World Health Organization Monograph Series, No. 30. World Health Organization, Geneva, 1956 (order from Columbia University Press, New York 27). 238 pp. Illus. $5.

In the story of the evolution and practical application of knowledge concerning yellow fever, the subject of vaccination is an important chapter and is very competently discussed in this monograph. An initial section by Smithburn sets the stage for the more technical sections that follow by reviewing the general question of the immunology of yellow fever. Appropriately, he considers in some detail serological methods for demonstrating

immunity but, unfortunately, at the same time he perpetuates a long-standing error of nomenclature by using the term *protection test* in reference to the demonstration of *in vitro* neutralization of virus by antibody. Apparently, this usage stems from the earliest tests for humoral antibody in which monkeys were protected by antiserum given separately from the virus.

The evolution, preparation, and use of yellow fever vaccines, of which there are two importantly different types, is then described. Durieux from the Pasteur Institute in Dakar, alone and with Koerber, speaks for vaccine made with the mouse-fixed French neurotropic strain of virus. Evidence is presented for excellent sero-immune response to such vaccine administered by scarification (often combined with vaccinia) and for satisfactory persistence of immunity with 82 percent or more of positive serums 7 to 12 years later.

Production and use of the less neurotropic 17D virus, grown in the chick embryo, in Brazil is described by Penna. For anyone concerned with mass application of injected vaccines, the detailed lists of equipment for field use should be of interest. G. W. A. Dick then describes the use of 17D vaccine by scarification with attendant advantages of simplicity and reduced cost of application. Curtois discusses immunity following 17D virus, citing evidence for its onset within 10 days and persistence for as long as 12 years; however, he quotes inaccurately from my own published work, particularly in discussing the possible relation of age to response and persistence of immunity.

Mass application of both types of vaccine is then considered. According to Durieux, 56 million vaccinations with Dakar vaccine had been made through 1954 in a French African population of about 25 million, accompanied by near elimination of reported cases of yellow fever. Manso reports on 22 million vaccinations with 17D virus in Brazil through 1954 and with no adverse effects since 1941 but is unable to muster data to show a decline in yellow fever morbidity, presumably because man is not involved in the jungle cycle of virus spread.

The longest section, by Stuart, considers the controversial question of post-vaccination reactions. Excluding allergic reactions and the serum hepatitis resulting from the now discontinued practice of incorporating "normal" human serum in the 17D vaccine, chief interest relates to the delayed, encephalitic reactions owing to the vaccine virus. For 17D virus this problem, never very serious, was resolved by choosing on the basis of a field trial a substrain of minimal encephalitogenic potential and "freezing" it at the passage level tested. However, recent reports suggest that in infants under 1 year of age encephalitis may still be induced. As for the Dakar vaccine, all agree on the hazard of using it in persons under 2 years of age. However, whereas encephalitis is rarely reported from French Africa, the same vaccine in Nigeria and Costa Rica gave rise to an alarming incidence with a high case fatality.

In final sections by Bonnel, international regulations are discussed, and a very excellent selected bibliography is presented.

All told, this monograph is a definitive presentation of the general and technical aspects of yellow-fever vaccination. It should interest the worker and teacher in microbiology and everyone concerned with problems of local and international public health.

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New Books

The Hardiness of Plants. J. Levitt. Academic Press, New York, 1956. 278 pp. $7.

Alcoholism as a Medical Problem. A conference held under the auspices of the Committee on Public Health of the New York Academy of Medicine and the New York State Mental Health Commission. H. D. Kruse, Ed. Hoeber-Harper, New York, 1956. 102 pp. $3.

Ultraviolet and Visible Absorption Spectra, Index for 1930–1954. Herbert M. Hershenson. Academic Press, New York, 1956. 205 pp. $10.

Gmelins Handbuch der Anorganischen Chemie. No. 28, *Calcium* (Technology), pt. B, sec. 1, 264 pp., DM. 147; No. 44, *Thorium and Isotopes,* 406 pp., $55.68; No. 60, *Copper,* pt. A, sec. 1, 710 pp., $92.85; No. 60, *Copper,* pt. A, sec. 2, 755 pp., $101.04. Edited by Gmelin Institute. Verlag Chemie, Weinheim, West Germany, ed. 8, 1955.

Physics and Chemistry of the Earth. vol. 1. L. H. Ahrens, Kalervo Rankama, S. K. Runcorn, Eds. McGraw-Hill, New York; Pergamon, London, 1956. 317 pp. $8.

Gas Chromatography. Courtenay Phillips. Academic Press, New York; Butterworths, London, 1956. 105 pp. $3.80.

Cryptococcosis. Torulosis or European Blastomycosis. M. L. Littman and Lorenz E. Zimmerman. Grune & Stratton, New York–London, 1956. 205 pp. $8.50.

Chromium. vol. 1, *Chemistry of Chromium and Its Compounds.* Marvin J. Udy. Reinhold, New York; Chapman & Hall, London, 1956. 433 pp. $11.

Insects and Spiders. A book of keys with biological notes. C. P. Friedlander and D. A. Priest. Philosophical Library, New York, 1956. 124 pp. $2.75.

Catalysis. vol. IV, *Hydrocarbon Synthesis, Hydrogenation and Cyclization.* Paul H. Emmett, Ed. Reinhold, New York; Chapman & Hall, London, 1956. 570 pp. $12.50.

Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Electron Physics Tables. L. Marton, C. Marton, and W. G. Hall. NBS Circ. 571. (Supersedes pt. II of Mathematical Table 17.) National Bureau of Standards, Washington, D.C., 1956 (order from Supt. of Documents, GPO, Washington 25). 83 pp. $0.50.

Report of the Second Technical Meeting on Cooperatives in the Caribbean. Held at Georgetown, British Guiana 24–31 Jan. 1956. Food and Agriculture Organization of the United Nations, Rome, Italy, and Caribbean Commission, Port-of-Spain, Trinidad, 1956. 22 pp.

Patents on Light Weight Ceramics. Bull. of the Virginia Polytechnic Institute Engineering Expt. Sta. Ser. No. 111. Compiled and edited by A. J. Metzger. Virginia Polytechnic Institute, Blacksburg, Va., 1956. 69 pp. $0.25.

ASTM Standards on Metallic Electrical Conductors. Copper and copper alloys, copper-covered steel, aluminum, iron and steel. Sponsored by ASTM Committee B-1 on Wires for Electrical Conductors. American Society for Testing Materials, Philadelphia, 1956. 298 pp. $3.50.

Teaching by Closed-Circuit Television. Report of a conference sponsored jointly by the Committee on Television of the American Council on Education and State University of Iowa. Iowa Continuation Center, Iowa City, 26–28 Feb. 1956. American Council on Education, Washington, D.C., 1956. 66 pp.

The Mutants of Drosophila Melanogaster Classified according to Body Parts Affected. Norma B. Braver. Carnegie Institution of Washington, Washington, D.C., 1956. 36 pp.

Spring Lake Archeology, the Lee Mill Cave. Science Bull. No. 3, pt. 2. Elden Johnson and Philip S. Taylor. Science Museum of the St. Paul Institute, St. Paul 3, Minn., 1956. 31 pp. $1.

American Society of Civil Engineers, Directory 1956. Membership lists as of 15 Mar. 1956. American Society of Civil Engineers, New York 18, 1956. 797 pp.

Bibliography of Herman Goodman, M.D. Medical Lay Press, New York, 1956. 48 pp.

Colloque sur la Théorie des Nombres. Held at Brussels 19–21 Dec. 1955. Centre Belge de Recherches Mathématiques. Georges Thone, Liège; Masson, Paris, 1956. 204 pp. F. 2400.

Soil-Testing Methods. Moisture, density, classification soil-cement. Highway Research Board Bull. 122. 47 pp. $0.90. *Bituminous Resurfacing.* Highway Research Board Bull. 123. 39 pp. $0.75. National Academy of Sciences–National Research Council, Washington, D.C., 1956.

Planning for Progress. American Institute for Research Pittsburgh, Pa., and Washington, D.C., 1956. 44 pp.

Education in Taiwan (Formosa). Bull. 1956, No. 3. Abul H. K. Sassani. U.S. Office of Education, Washington, D.C., 1956 (order from Supt. of Documents, GPO, Washington 25, D.C.) 34 pp. $0.20.