about technical limitations and the reliability of the measurements.

While this book was on my desk for review, I handed it to colleagues in various neurological disciplines for their first-hand impressions. Each invariably turned to something in his own specialty that he found to be of particular interest. There were relatively few negative reactions. One reader noted immediately that only 10 of the 12 cranial nerves were included. Another expressed surprise at finding the amygdala included under the basal ganglia, and another told me later that he was led astray by one of the references. The general impression, however, was that this book would provide an excellent starting point for anyone beginning to search the literature for quantitative data on some particular structure. As there is no immediate threat that computers will make passé the information contained in this book, it promises to be a reference that will be around for quite a while.

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Experimental Carcinogenesis

Tobacco and Tobacco Smoke. Studies in Experimental Carcinogenesis. ERNEST L. WYNDER and DIETRICH HOFFMANN, with chapters by others. Academic Press, New York, 1967. xiv + 730 pp., illus. $29.

This book is based on the premise that cigarette smoking is the major cause of lung cancer. Its justification is indicated in the preface as follows: "Here then lies the major task at this time: the effective achievement of an experimental reduction or elimination from tobacco smoke of tumorigenic constituents and of compounds that enhance their effect." The elimination of potentially hazardous constituents is one objective with which I believe most can agree, from those who are responsible for the prevention of disease to those who produce and sell products that are claimed to cause disease. If the search is successful, then all can rejoice. If it is unsuccessful, judged with the guidance provided by available biological models, then either the models are inadequate or the real major cause lies elsewhere. The dramatic decline of stomach cancer in recent years is unexplained, but obviously a similar happening in lung cancer would be welcome, explainable or not.

The authors have made a fine contribution in presenting in one volume references to much of the pertinent literature and a great deal of their own work. The chapter by Wolf on tobacco production and processing represents an excellent summary of the multiplicity of variables which occur or can be controlled in preparing tobacco for at least temporary enjoyment by man. This includes not only cigarette tobacco but also cigar, pipe, and chewing tobacco and snuff.

In recent years the tobacco industry has made increasing use of reconstituted tobacco sheets, and Moshy reports in his chapter that 15 percent of the tobacco used in American-blend cigarettes (1964) is in this form. (He does not mention cigar tobacco, although reconstituted tobacco sheets have found acceptance in cigar manufacture also.) This is a chapter on the technology involved in the utilization of fragmented tobacco or tobacco dust to make sheets by five basic processes, namely, the dust-impingement process, the slurry process, the impregnation-of-web process, the paper process, and the extrusion process. As Moshy says, "The very real possibilities of making specific physical-structure modifications in reconstituted tobacco sheet and of adding chemical ingredients to affect the nature and degree of combustion of reconstituted sheet have not been adequately investigated. The implications of these added tools in fabricating smoking materials that meet technical as well as consumer requirements are technologically and scientifically appealing."

Chapter 5, "Some characteristics of tobacco smoke," gets off to an unfortunate start as follows: "During tobacco smoking, as in most combustions, organic matters burn incompletely. A complete combustion, if such would occur, would form no smoke, but only carbon dioxide and water." Despite this lapse (as the authors know as well as you and I that tobacco contains more than carbon, hydrogen, and oxygen), this chapter provides a good general description of the properties of cigarette smoke and of a variety of machines used to produce and collect it. One will not, however, find described the machine adopted in 1967 by the Federal Trade Commission to provide information on the tar and nicotine content of various cigarette brands.

Chapter 6 deals with selected laboratory methods in tobacco carcinogenesis. It presents in considerable detail the methods in use in the authors' laboratory, which include both short-term and long-term mouse-skin painting, assays of cilia toxicity in clams, and chemical analysis for "tar," nicotine, and numerous other constituents of tobacco smoke and smoke condensate. A graph for the mouse-skin painting experiments indicates that the number of mouse-skin tumors produced by cigarette smoke condensate has decreased between 1954 and 1963 by more than one-half.

Chapter 7 contains a 56-page table summarizing various published attempts to produce cancer in animals with smoke or smoke condensate and its fractions. The inhalation route has been unsuccessful in producing bronchogenic carcinoma, but mouse-skin tumors have been produced in many laboratories. The difficulties that apply to inhalation techniques are described at length. The production of pulmonary carcinoma *in situ* by the Leuchtenbergers early in their experiments is mentioned, but the fact that this was not followed by the development of carcinoma even though the animals were exposed for long periods thereafter is not mentioned. The experiment by Rockey is cited in several places in the book, at times, as on page 150, to indicate that invasive carcinoma resulted after 11,000 tar applications and five years' study, although on page 195 it is correctly indicated that only one invasive carcinoma was found in this study and that it was found only 11 days after the start of the experiment.

Chapters 8 and 9 contain an extensive summary of tobacco and smoke components that have been identified and an attempt to assess their biological properties. There are also two excellent chapters on filtration and selective filtration by Kiefer and Touey and by George and Keith, respectively. Had the Columbia people had the section on pressure drop on page 563 to read last spring, the revolutionary-breakthrough-cigarette-filter press conference of last July would presumably not have occurred.

The major authors have pressed some observations or interpretations to fit their preconceived ideas, but the book as a whole is an objective presentation of the state of the art of tobacco technology and experimental

tobacco carcinogenesis as of the end of 1965 and should prove useful to those interested in the physical, chemical, and biological properties of tobacco smoke. The book is well printed and bound, although some of the photomicrographs are not of the highest quality.

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Essays by Kapitza

Collected Papers of P. L. Kapitza. Vol. 3. D. TER HAAR, Ed. Pergamon, New York, 1967. x + 244 pp., illus. $13.50.

This volume of Kapitza's papers is devoted to general, semipopular surveys of technical subjects, biographical essays, and essays on the organization and future of science and its impact on the human condition. Its primary interest, therefore, lies not in its scientific content in the narrow sense but in the insight it provides into the thoughts and the development of ideas in the mind of one of the great physicists in our time—one who has not only scaled the Olympian heights of pure research but has battled the tides and achieved safe passage through turbulent and treacherous crosscurrents of political pressure, retaining loyalty to principle and conscience.

Imperfect analogies are easily constructed. We have a strong natural urge to seek them out and embellish them when comparing lives of great scientists whose names and whose works contribute to the substance of our learnings as well as teachings. This reviewer found in the pages of these writings parallels between the careers of Peter Kapitza and J. Robert Oppenheimer. Both were developers of leading schools of physics in their respective nations, to which they returned (albeit in different circumstances) from European centers of learning. Both were distinguished organizers in fostering the growth of modern physics in their countries. Recognizing the importance of big facilities in the future of experimental science, both were closely associated with the development of "big physics" in their respective countries. Both were driving forces during the Second World War in their countries' wartime science efforts. Both suffered precipitous falls from grace when they refused to give way to hysterias of the political moment that were running rampant in their countries; and both were eventually vindicated and enjoyed rehabilitation as heroes. As articulate, cultured scientists and statesmen of science, both have deeply and eloquently expressed their concerns for humanity's survival in a nuclear age.

The papers in this book span more than half a century, from the teenager's investigation of the production of cod liver oil that appeared in 1913 to recollections of Lord Rutherford first published in the 1966 *Proceedings of the Royal Society* on the occasion of Kapitza's return to the scene of his earliest scientific fame. To this reviewer, the perceptive and beautifully written essays on the lives of great scientists—Rutherford, Newton, Benjamin Franklin, Paul Langevin, Lomonosov, and Niels Bohr—comprise the most enjoyable portion of this volume. Not only is the style charming, but the color is rich, and the scientific examples and anecdotes that spice these biographies are both entertaining and substantive in transforming them into significant essays on the essence of science. They should be valued in the teaching of young scientists to help convey the excitement and the fascination of natural science.

It is also interesting to follow through the line of Kapitza's thinking in the 1930's and 1940's that led him to concentrate his research on producing strong pulsed magnetic fields for studying important dynamical properties of atoms and on producing liquid air in quantity in order to pursue the low-temperature research that led to deep insights into the property of superfluidity in liquid helium II. He always strove to extend the realm of physical parameters amenable to measurements, quoting Davy's "One good experiment is worth more than the ingenuity of a brain like Newton's." (Speaking as a present-day particle theorist hoping to see new accelerators bring still higher energy events into the realm accessible to quantitative study, I fully concur—especially as I labor in the current theoretical morass and cacophony of concepts.)

Some of the essays of the 1940's are political period pieces, but it is timely to reflect on Kapitza's dialogue with Bertrand Russell in 1956 in which he remarks:

> . . . in concluding international agreements which have the aim of preventing atomic war, it is necessary to take into account the possibility of inventing an effective means of defence. In such agreements it is necessary to provide for mutual notification of the course of experimental work on defensive measures, though this may complicate the conditions of mutual supervision over fulfilment of the agreement.

Updating this observation, on his recent visit to Britain in 1966, Kapitza was quoted in the New York *Times* of 5 May 1966 as having suggested "as his formula for peace an international 'exchange of scientists from military institutions.' 'Then there would be no more secrets,' he observed with a puckish smile, adding that he supposed it would not come to pass 'for some time, you know.'" As the world's strategic arms race continues with new and better ICBM's, joined now by ABM's, can someone come forth with a better idea?

The much honored career of Kapitza needs no recapitulation or synopsis in this review. His name is too well known and respected by the scientific community. His book should be enjoyed for what it does, namely give us a charming and at the same time significant glimpse into the thinking and ideas of an important scientist of our times who has the ability of expressing his thoughts clearly and of writing in a delightful manner, whether discussing the future of science in society, reminiscing about the great men of science, or describing how he himself was drawn to his own important scientific work.

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Assaying Chromosome Damage

Human Radiation Cytogenetics. Proceedings of an international symposium, Edinburgh, Oct. 1966. H. J. EVANS, W. M. COURT BROWN, and A. S. MCLEAN, Eds. North-Holland, Amsterdam; Interscience (Wiley), New York, 1967. viii + 218 pp., illus. $11.50.

One consequence of the development of an easy and reliable technique for culturing human somatic cells has been a rash of reports dealing with the induction, by ionizing radiations, of chromosomal aberrations in peripheral lymphocytes. These reports have dealt not only with studies in vitro but also with studies in vivo stemming from accidental and therapeutic exposures. Understandably, the large and diverse group of researchers utilizing their own modifications of a basic technique have