Book Reviews

Manning a New Technology: A Case History

Scientific and Managerial Manpower in Nuclear Industry. JAMES W. KUHN. Columbia University Press, New York 1966. 229 pp. $7.50.

James W. Kuhn tells here the interesting story of the manpower problems encountered by the Atomic Energy Commission and the electrical utilities in harnessing nuclear energy for the practical production of electric power. The account is based on a study conducted by the Conservation of Human Resources Project at Columbia University, and the author presents a wealth of information collected during the study through interviews with informed representatives of most of the major industries and groups that played a role in the nuclear-power revolution, as well as from documentary sources. The abundant details, and Kuhn's succinct comments and conclusions, will engage the attention of anyone concerned with the management of research and development.

The nuclear-power industry was chosen for study because "trained manpower played a key role in its creation and expansion." In fact, Kuhn tells us, the earliest efforts directed toward producing nuclear power originated in make-work designed to retain and occupy the specialized scientific talents and skills that would be needed in case serious difficulties arose in the plutonium-production reactors.

Discussing the AEC's manpower policies, Kuhn observes that there never really was a gross shortage of technical personnel, except of the truly gifted men so essential in the expeditious solution of a succession of complex problems. The Commission's on-the-job training programs for both professional and semiskilled personnel were highly successful, and the new technology was speedily routinized so that it could be handled by workers with only limited technical backgrounds. Much of the later progress in nuclear-power technology is attributable to these measures, which expanded the country's pool of trained manpower.

In industry, Kuhn reports, a host of major problems stemmed from the failure of many company officials to recognize the development of nuclear power as revolutionary progress rather than as merely an advancement of a conventional technology. The traditional "lean" manpower policies of the electrical utilities were not adequate to cope with the rapidly expanding technology and with the rigid regulations necessitated by military potential and by the possible hazards to public health and safety. The pressures for short-term returns on investments created additional difficulties. It was the threat of public power that forced the utilities to revise their policies and outlook and to become acquainted with the possibilities and limitations of nuclear power. This they did effectively by learning to work with government officials and with a variety of consultants—scientists, research engineers, university scholars. Kuhn draws a lesson here regarding the importance, for innovatory development, of the initial selection of personnel:

> The men called upon as advisers or used as managers and employees can determine the pace and direction of an organization's attack upon, and use of, a technology, fixing the perspective in which it is seen and thus influencing the strategies for approaching the perceived problems.

Throughout, Kuhn makes crystal clear that the demands of nuclear technology have broken through institutional boundaries within which men were accustomed to work. He says in his foreword:

> The major manpower innovation which characterized the manufacture of the bomb and the later successful development of nuclear power initiated a vast proliferation of group research in which physicist, engineer, chemist, mathematician, and many others had to work together, learning from each other and contributing to solving the successive barriers that blocked their way.

And he returns to this theme in his concluding chapter, "Manpower lessons":

> The most hopeful approach toward meeting the manpower problems of rapid technological change may lie in fostering a greater variety of organizations and institutional arrangements through which the work of developing a technology can be carried on. Such an approach can help to increase the opportunity for individuals to escape limiting positions and restrictive assignments, and then better prepare themselves for the changing demands of technology. The more alternatives that are available for individuals, the more responsive firms and organizations are apt to be to their needs and demands, and the less scholars, officials, and experts need resort to exhortation to solve our manpower problems.

The book is a significant contribution and sets the stage for the study of numerous questions that must be answered in effecting major advances in the development and utilization of technical manpower.

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Radiowaves

Tropospheric Radiowave Propagation beyond the Horizon. FRANÇOIS DU CASTEL, E. Sofaer, tr. Pergamon, New York, 1966. 248 pp., illus. $11.50.

This volume is a partial translation of du Castel's 1961 book *Propagation Troposphérique et Faisceaux Hertziens Transhorizon.* Only those chapters dealing with tropospheric propagation are included, and these have been revised and updated in the translation.

The introduction contains a brief review of the lively development of divergent theories of tropospheric propagation. Du Castel gives credit to his co-workers and himself for developing the whole theory, in a 1960 paper, by synthesizing the scattering theory and the reflection theory. The six remaining chapters deal with both theoretical and experimental investigations. These are presented in such a way as to be useful for both the student and the practitioner. The first chapter deals

with general conditions of propagation. The refractive index structure of the atmosphere—turbulence and layering—is treated extensively, and theories of mixing in gradients and of turbulent mixing are briefly described. Other subjects treated in this chapter are refraction, reflection, diffraction, and absorption. Geometric optic and wave optic methods are both used, with considerable emphasis being placed on ray-tracing techniques. The discussion on atmospheric noise is really a consideration of the contributions of all types of noise, including receiver, man-made, and cosmic noise. The author prefers the concept of equivalent noise temperature to the use of a noise factor.

The next chapter is concerned with experimental trans-horizon measurements, all made prior to 1961. The data have been selected to show trends and variations with distance, time, frequency, antenna height, and from path to path. Antenna gain and beam-width performance in trans-horizon measurements are summarized, as are the conclusions of various investigators. Statistical analyses, including the Rayleigh distribution, autocorrelation, and power spectra analyses of phase-interference fading phenomena, are briefly discussed, and data on frequency-selective fading measurements and bandwidth limitations are presented.

In the remainder of the book, the author gives theoretical interpretations. He starts with the development of theories of smooth-earth diffraction in a homogeneous atmosphere and then brings in irregularities and nonhomogeneities. Emphasis is placed on explaining the approaches of various theoreticians in modeling and formulating propagation theories. The author's own attempt to synthesize scattering and reflection into a unified theory is discussed in some detail. The final section of the book deals with practical methods for determining attenuation. A number of loose graphs are included in a back cover pocket; these are useful in predicting propagation attenuation for cases of free space and of plane, cylindrical, and spherical diffraction, as well as in accounting for the effects of geometry, meteorology, frequency diversity, coupling loss, and other factors. The methods are original with the author, although brief descriptions of the theoretical and empirical methods of others are given in an appendix. Although the author carefully points out that accuracy in the estimates is of prime importance, a basic weakness of the book is the lack of any comparison of the accuracy of predictions made by his methods with that of predictions made by other available methods.

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Two Symposiums on Chromosomes

Chromosomes Today. Proceedings of a symposium (Oxford, England), July 1964. C. D. DARLINGTON and K. R. LEWIS, Eds. Plenum, New York, 1966. 286 pp., illus. $11.50.

Chromosome Manipulations and Plant Genetics. Contributions to a symposium held during the Tenth International Botanical Congress (Edinburgh), August 1964. RALPH RILEY and K. R. LEWIS, Eds. Plenum, New York, 1966. 131 pp., illus. $8.

During the summer of 1964 two conferences were held on the subject of chromosomes. The proceedings of both of these were published during 1966. The larger volume, *Chromosomes Today*, contains the papers presented at the First Oxford Chromosome Conference. In introducing this conference, its president, C. D. Darlington, wrote an engaging piece on "The chromosomes as we see them." The "we" in this sentence should be regarded as either presidential or editorial, since the article is pure Darlington as cytologists have come to know him. He begins with a brilliant, succinct, and penetrating statement of the structural and functional complexity of chromosomes as organelles in their own right which should be regarded neither as mere aggregates of genes nor as completely dependent parts of organisms to be studied as wholes. He then proceeds through a statement of Weismann's pre-Mendelian views to a characterization of modern biologists as he sees them. These are neatly categorized into five types: the anatomist, the chemist, the experimental breeder, the mathematical geneticist, and the naturalist. Each of these types is made into a straw man of narrow outlook whose ideas are easily bowled over, leaving the field of biology to the preeminence of the chromosome cytologist. The fact that few modern biologists fit into his types is a disturbing element which Darlington conveniently ignores.

Most of the other 31 papers in the volume are brief reports of new research on chromosomes. They are most noteworthy for their diversity, the lack of connection between them, and the fact that for the most part they are embellishments of well-worn themes. Four of those on plants deal with the much studied but still imperfectly understood B chromosomes; two deal with special examples of polyploidy; one with translocations; and three with the mechanics of meiosis. All represent sound, careful work which is of a technical level much higher than that of cytology 10 to 20 years ago. As additions to our knowledge about chromosomes, none of them is of major significance. The unusual giant chromosomes which D. U. Gerstel and J. A. Burns report in certain hybrids of *Nicotiana* are the only real surprise in this section, and certainly deserve further attention. Eva Sansome calls our attention to the probable but unexpected diploid condition in a primitive group of fungi, the Oömycetes.

The second section, on nuclear structure, centers largely about the relations between DNA synthesis, chromosome breakage, and mutations. It contains a number of valuable contributions to the now voluminous literature in this field. The analysis by B. A. Kihlman of the effects of various nucleotide analogues is perhaps the most significant paper of this group. Remarkable filamentous structures in the nucleoli of plant endosperm tissue are illustrated by L. F. La Cour. These will deservedly attract much attention and may eventually provide a basis for a better understanding of the function and metabolism of these once mysterious but now more comprehensible organelles.

The final section of the volume contains ten papers on animal chromosomes. Noteworthy among them is that by Oswald Hess on the structure and activity of normal and modified Y chromosomes in *Drosophila*. Two papers, one by D. T. Hughes and the other by J. S. S. Stewart and R. C. G. Killean, attempt quantitative comparisons of karyotypes with the use of the digital computer. This new technique will undoubtedly gain in importance as cytologists seek to make more precise their morphological comparisons be-