

other distinctive contribution. It will be very helpful to investigators in the fields of genetics, tumors, endocrinology, as well as pathology and biology in general.

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MATHEMATICS

University Mathematical Texts. General editors, Alexander C. Aitken, D.Sc., F.R.S., Daniel Rutherford, Dr. Math. Edinburgh and London: Oliver and Boyd. New York: Interscience. *Determinants and Matrices*, by A. C. AITKEN; *Statistical Mathematics*, by A. C. AITKEN; *Waves*, by C. A. COULSON; *Integration*, by R. P. GILLESPIE; *Integration of Ordinary Differential Equations*, by E. L. INCE; *Functions of a Complex Variable*, by E. G. PHILLIPS; *Vector Methods*, by D. E. RUTHERFORD; *Theory of Equations*, by H. W. TURNBULL. Each volume, \$1.50.

IN continental Europe the publishing of brief introductory texts at a low price has long been an established custom. It is very fortunate that, by constructive editorial activity, the present mathematical series in the English language was started. All the little books of the series published so far can be characterized as unassuming, straightforward, directed toward tangible facts rather than toward generalities, conscious of applications, and written by competent authors. They can not possibly give more than introductory information and they can not suffice as bases for more detailed studies. But within the limitations imposed by their small size (about 65,000 words on the average), they will serve a really useful purpose. It is to be hoped that the editors will be able to maintain the same standards in the future publications of the series.

A Treatise on Advanced Calculus. By PHILIP FRANKLIN, Ph.D., professor of mathematics, Massachusetts Institute of Technology. xiv + 595 pages. New York: John Wiley and Sons. 1940.

RIGOR, whatever this word may mean, was one of the great mathematical achievements of the nineteenth century. Only gradually has this tendency penetrated into text-books. The first great work of this kind, Jordan's "Cours d'analyse," was followed by many others, of which Hardy's "Pure Mathematics" seems to be the foremost in English. Franklin's book is an admirable attempt on a much broader scale to combine rigor with completeness in a volume of modest size. It will appeal to readers who are already well informed but want to revise and to supplement their knowledge in the light of modern precision. Not only are the traditional subjects of a book on advanced calculus covered, but also many more advanced topics are included. There is a section on the Laplace transformation, one on Poisson's sum formula, and a brief exposition of the theory of partial differential equations of the first order. The material is presented in an original way with extraordinary care.

Of course it is impossible to discuss analysis from the real number system to the Hamilton-Jacobi theory in less than 600 pages without being somewhat dogmatic. The reader who wants to absorb new material will miss a convincing illumination of motives and goal for all these deductions. The critic may take exception to points where the personal taste of the author has asserted itself in a striking way, such as in the discussion of the trigonometric functions. Or he might be disappointed to find in such a thoughtfully precise book an introductory remark on limits, where the idea of a steadily moving independent variable is mentioned without being explicitly disavowed. From Zeno to Leibniz this concept has been one of the main impediments to rigorous mathematical treatment, and its replacement by "static" concepts was the decisive step towards logical clarity in the modern definitions of limit and continuity. Of course such criticism of minor details does not matter much in view of the merits of the book as a reliable guide. The great effort embodied in this work will certainly assure it a more than transitory place in the literature and a lasting influence on those for whom it is written.

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SPECIAL ARTICLES

THE EFFECT OF SULFANILYLGUANIDINE ON THE THYROID OF THE RAT¹

FOLLOWING the announcement of Marshall *et al.*² that orally administered sulfaguanidine (sulfanilyl-

¹ Supported by a grant from The Rockefeller Foundation.

² E. K. Marshall, Jr., A. C. Bratton, H. J. White and S. T. Litchfield, Jr., *Bull. Johns Hopkins Hosp.*, 67: 163, 1940.

guanidine) reduces the concentration of coliform bacteria in the feces of mice, we investigated the possibility that this substance, when fed to rats on a purified diet containing synthetic B vitamins, would prevent the synthesis of additional essential nutrients by the intestinal flora. In view of Woods's³ finding that p-amino benzoic acid interferes with the bacteriostatic

³ D. D. Woods, *Brit. Jour. Exp. Path.*, 21: 74, 1940.

action of sulfanilamide, its effect on rats fed diets containing sulfaguanidine was explored. The action of yeast was also tested. At the time of the completion of this work, Black *et al.*⁴ reported that liver extract, and to a lesser degree p-amino benzoic acid, prevented the growth-inhibiting effect of sulfaguanidine in rats fed a purified ration. Our results on growth are in general agreement with theirs.

We wish to report the extensive alterations observed in the thyroids of rats fed sulfaguanidine⁵ in a diet containing synthetic B vitamins⁶ and p-amino benzoic acid, or in a diet containing yeast.

The basal ration was composed of purified casein 200, sucrose 600, lard 40, salts 60, 2-methyl-1,4-naphthoquinone 0.005, and 13 drops of haliver oil fortified with viosterol. To this mixture was added either 100 parts of dried yeast, or 5 mg each of thiamin, riboflavin and pyridoxin, 15 mg of calcium pantothenate, 250 mg of choline, and 500 mg of cystine, with or without 2.5 gm of p-amino benzoic acid. When added, sulfaguanidine was incorporated at a 1 or 2 per cent. level. The distilled drinking water contained 20 mg of iodine and 40 mg of potassium iodide per liter one day a week.

Rats from our stock colony were placed on these diets at 21 to 23 days of age. Animals receiving sulfaguanidine were sacrificed at periods varying from 6 to 16 weeks. Without exception their thyroids were hypertrophied and hyperemic. The glands were 3 to 8 times larger than those of the control animals receiving the same diets without sulfaguanidine. Rats on the diets containing synthetic B vitamins (without p-amino benzoic acid) plus sulfaguanidine developed bleeding from the anterior corner of the eye, which later involved the whole eye. This symptom was prevented by p-amino benzoic acid in rats receiving 1 per cent. of sulfaguanidine, but not in those receiving 2 per cent. It was always prevented by yeast.

A second experiment was conducted in which rats on the yeast diet plus 1 or 2 per cent. of sulfaguanidine were killed at the end of 4 weeks and their thyroids removed for sectioning. The glands were hyperemic and 3 to 4 times larger than those of the control animals on the yeast diet without sulfaguanidine. Histologically, the thyroids of the 2 per cent. sulfaguanidine rats showed marked hyperplasia. The epithelium was distinctly columnar, and in most follicles so increased and invaginated as to nearly extinguish the lumen. But few of the lumina contained colloid, and where present it was vacuolated and

shredded. The connective tissue was not appreciably increased, but the glands were very vascular. In the rats receiving 1 per cent. sulfaguanidine, the thyroids contained a little more colloid; and the columnar epithelium was not so invaginated, otherwise the picture was the same. The thyroids of the control rats were normal. They contained an abundance of colloid and the epithelium was of the cuboidal type. Histological examination of the kidneys of these sulfaguanidine animals revealed no abnormalities. The bladders and ureters contained no visible calculi. The growth of the rats on both levels of the drug equaled that of the controls during the 4-week experimental period, and no gross symptoms were observed. (After the fourth week there is a retardation in the rate of growth.) It is of interest to note that Richter and Campbell⁷ have very recently reported similar thyroid changes in rats fed phenylthiocarbamide.

At present we are investigating the effect of increasing the iodine intake at the beginning of the experiment and after the thyroid has hypertrophied. We are also testing the action of other "sulfa" drugs, sulfanilic acid, guanidine and thiourea on the thyroid in several species. The results of these studies together with a detailed account of the above observations will be published elsewhere in the near future.

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EFFECT OF ULTRAVIOLET LIGHT ON POLYCYCLIC HYDROCARBONS IN STEROL SURFACE FILM SYSTEMS

IN the course of a detailed study of the interaction of carcinogenic and other polycyclic hydrocarbons with sterols and other cellular constituents in mixed films at the air-water interface,¹ the conditions under which such hydrocarbons undergo ultraviolet decomposition have been investigated. Since these experiments may have some bearing on (a) the mechanism of detoxification and disposal of hydrocarbons subject to carcinogenic experiments,² and (b) the intense photodynamic effects exhibited by polycyclic hydrocarbons on bacteria³ and other cells,⁴ a preliminary statement of the results is presented here.

In such mixed films with sterols, certain polycyclic

¹ C. P. Richter and K. H. Campbell, *Arch. Path.* (in press).

² W. W. Davis, M. E. Krahle and G. H. A. Clowes, *Jour. Am. Chem. Soc.*, 62: 3080, 1940.

³ L. Velluz, *Compt. rend. Acad. Sci.*, 206: 1514, 1938.

⁴ A. Hollaender, P. A. Cole and F. S. Brackett, *Am. Jour. Cancer*, 37: 265, 1939.

⁵ I. Doniach and J. C. Mottram, *Nature*, 145: 748, 1940.

⁴ S. Black, J. M. McKibbin and C. A. Elvehjem, *Proc. Soc. Exp. Biol. and Med.*, 47: 308, 1941.

⁵ We are indebted to Lederle Laboratories, Inc., for the sulfaguanidine used in this experiment.

⁶ We are indebted to Merck and Company, Inc., for supplies of the synthetic vitamins.