

tionist would, I suppose, take to connote a haphazard origin of the factors so designated, since much investigation has been and is being devoted to a discovery of the causes of just such variations—all of which would be so much time thrown away if they actually respond to no law whatever.

But unfortunately certain would-be popularizers of science and superficial thinkers with scientific pretensions have interpreted these terms in accordance with the popular meaning and have spread abroad an impression that science denies design in nature. Certainly, science does not affirm it, because to do so would be to usurp the functions of philosophy. But she is so far opposed to the haphazard that no one would be more startled than a scientist at the appearance of an absolutely uncategorizable or lawless phenomenon. Science will not deny the possibility of such an apparition, but she will wait to be shown.

Much disturbance of the sensibilities of the religious minded will be avoided and a load of prejudice removed from the minds of great masses of people if teachers of evolution will take pains to explain to their classes the exact sense in which "chance," "accident" and similar terms are understood by scientific investigators.

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SCIENTIFIC BOOKS

TWO RECENT HISTORIES OF ELEMENTARY MATHEMATICS

THE literature of the history of elementary mathematics has recently been greatly enriched by the appearance of two unusually extensive works. One of these was published during the years 1921-1924, in seven small volumes, composed altogether of about 1,300 pages, while the other was published during the years 1923 and 1925, in two volumes, involving together about 1,350 pages. The former was written by J. Tropicke, Oberrealschuldirektor, Berlin, Germany, and bears the title "Geschichte der Elementar-Mathematik," while the latter bears the more general title, "History of Mathematics," and was written by D. E. Smith, Teachers College, Columbia University. While both of these works should be of considerable interest to the student of the general history of science, the latter will probably appear especially attractive to such a student.

It may be of interest to note here that the term *elementary mathematics* is used with different meanings by the authors of the two works under consideration. D. E. Smith uses this term for "mathematics through the first steps in the calculus," while J.

Tropicke excludes the calculus from the subjects covered by this term, placing its upper limit at the close of the elementary developments in analytic geometry. This is in accord with the fourth edition of volume 1 of the well-known "Encyklopädie der Elementar-Mathematik," by Weber and Wellstein, while the definition used by D. E. Smith is in accord with the earlier editions of this volume, as well as with common usage in our country. Notwithstanding the fact that the work by Smith aims to reach a somewhat higher limit as regards the subjects treated than that by Tropicke it actually presupposes less mathematical knowledge on the part of the reader and pays less attention to the more advanced developments in the subjects considered by both of these writers.

The subtitle of the first volume of this work by Smith is "General survey of the history of elementary mathematics," and in each of its ten chapters a brief sketch of the development of elementary mathematics during a certain period is given, beginning with "pre-historic mathematics" and ending with the mathematics of the "eighteenth century and after." The subtitle of the second volume of the same work is "Special topics of elementary mathematics," and it is also divided into ten chapters, with the following headings, in order: Development of the arithmetica, logistic of natural numbers, mechanical aids to calculation, artificial numbers, geometry, algebra, elementary problems, trigonometry, measures, the calculus. The subject of analytic geometry is treated very briefly in the chapter devoted to geometry and only twenty-seven pages are devoted to the history of the calculus.

The fact that there is now a demand for such extensive works devoted to the history of elementary mathematics is evidence of a rapidly growing interest in the history of science. Teachers of elementary mathematics will find in these works a large amount of material which may be used occasionally to exhibit the fact that the modern form of elementary mathematics seems, in many cases, to have resulted from the survival of the fittest, and to be much more free from difficulties than the earlier expositions. In particular, many elegant results which can now be easily established by means of Taylor's theorem escaped the notice of such shrewd minds as those of Newton and Leibniz, who are commonly credited with the invention of the calculus. The cheerful view that the human race is making actual progress in realms of abstract knowledge and that at least some truths are definite and not merely relative is perhaps supported more strongly by the history of elementary mathematics than by any other subject with which the young students become familiar.

An interesting feature of these works is the fact

that attention is frequently directed to necessary modifications as regards older views. The deeper study of some of the questions considered therein will doubtless give rise to further necessary modifications. The unusually extensive lists of references which they present will be very useful to those who desire to enter more deeply into the study of certain historical questions. Hence it is to be hoped that these extensive works will serve not only as a source of information for those interested in the history of the development of elementary mathematics, but still more as a stepping-stone towards a deeper general insight into this history. The pursuit of such insight rather than the accumulation of historical facts should dominate the student of the history of science.

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SPECIAL ARTICLES

SEROLOGICAL OBSERVATIONS ON THE RELATIONSHIP OF THE BLOODS OF MAN AND THE ANTHROPOID APES¹

MUCH attention has been paid to the work of Grünbaum² and of Nuttall³ who studied the relationship between man and the anthropoid apes by means of the precipitin reaction. They found that the sera of man and chimpanzee were indistinguishable by this means. In Nuttall's tests with anti-human precipitin the intensity of the reaction decreased gradually in this order: chimpanzee and man, gorilla, orang, lower monkeys. As it has already been pointed out⁴ that the antigens involved in the lytic and agglutinative reactions of red blood corpuscles differ essentially from the antigenic proteins concerned in the precipitin reaction, a comparative study of the serological behavior of the blood cells of the primates has been undertaken.

When immune agglutinins against human or chimpanzee erythrocytes (immune rabbit sera) were tested with several specimens of blood of both these species there was found often but not constantly a difference in the titers against the two kinds of blood. These results resemble those with the precipitin reaction. If, however, the method of absorption is employed, a striking difference between the two kinds of blood is brought out, so that there is no difficulty in differentiating the two species. We have been able to

confirm this observation repeatedly. In the only absorption experiment performed with orang blood similar results were obtained. As had been expected⁵ the reaction showed the differences: man—lower monkeys, and chimpanzee—lower monkeys, to be about equal among themselves and to be much greater than the difference: man—chimpanzee. This finding is in agreement with the view of zoologists that the anthropoids are not placed on a line leading from the lower monkeys to man, but that at a certain stage of evolution there separated one line which developed into the catarrhinae and another leading to the anthropoids and man.

The differences between the races of man were imperceptible by our technique in experiments made up to the present by the comparison of white and American negro bloods.

Of considerable interest was the search in anthropoid bloods for the occurrence of group specific substances similar to those in human blood, especially in view of the information accumulated in recent years by the work of H. and L. Hirschfeld⁶ and their followers on the distribution of blood groups in human races. Owing to the complication arising from the presence in human serum of heteroagglutinins for anthropoid blood, the following technique was employed: Human red cells groups II and III⁷ were agglutinated by human sera groups III and II, respectively. The cells were washed and the agglutinin separated from them by heating.⁸ As a second method immune sera against human group II and group III blood cells were absorbed with human blood cells of group I. The resulting liquids agglutinated specifically group II and III cells, respectively, and served very well for typing the anthropoid bloods. Both methods gave reactions with anthropoid blood in every way identical with those of human blood, while the bloods of other animals behaved differently. These reactions give additional proof of the close relationship between man and the anthropoids.

Of twelve chimpanzees examined three belong to group I and nine to group II. By including the two sera and one blood of chimpanzee reported by v. Dungern and Hirschfeld,⁹ apparently belonging to

¹ From the laboratories of The Rockefeller Institute for Medical Research, New York.

² Grünbaum, A. S. F., *Lancet* (1902, i), 143.

³ Nuttall, G. H. F., "Blood Immunity and Blood Relationship," Cambridge, 1904.

⁴ Landsteiner, K., and van der Scheer, J., *Jour. Exp. Med.*, xl (1924), 91. *Ibid.*, xli (1925), 427.

⁵ See H. T. Marshall's experiments on anti-human and anti-macacus hemolysins, *Jour. Exp. Med.*, vi (1901-1905), 347.

⁶ Hirschfeld, L. and H., *Lancet* (1919, ii), 875.

⁷ Nomenclature of the American Committee, *J. Am. Med. Assn.*, lxxvi (1921), 130.

⁸ Landsteiner, K., *Münch. Med. Woch.*, xlix (1902), 1905.

⁹ v. Dungern and Hirschfeld, *Z. Immunitätsf.*, viii (1911), 526.