*Eoanthropus* skull was probably a washout river channel specimen from some old sand or gravel bank and the problem is whether it came from a Pliocene gravel bank with the primitive elephant and mastodon, or from a Pleistocene gravel bank with a primitive hippopotamus.

In either case *Eoanthropus,* the dawn-man of Sussex, now appears to be of greater geologic age than *Pithecanthropus,* the Trinil ape-man. Thus in the course of the last eighteen years *Eoanthropus* and *Pithecanthropus* have changed places in the geologic time scale.

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## GROUP THEORY AND APPLIED MATHEMATICS

PROFESSOR H. WEYL, of Zurich, Switzerland, recently published a book under the title, "Gruppentheorie und Quantenmechanik," Leipzig, 1928, which he regards as half mathematics and half physics, and hence it belongs to the borderland of two large domains of science. Group theory is not a complete stranger in this borderland. Its usefulness in crystallography, for instance, is well known. The fact that it appears to be useful in such a new field of mathematical physics as quantum mechanics may perhaps be regarded as a sign that the mathematical public is becoming more conversant with the fundamental notions involved in group theory and hence writers no longer hesitate to express themselves in the language of this subject in case they are familiar with it.

Professor Simon Newcomb once said[1] that "the mathematics of the twenty-first century may be very different from our own; perhaps the schoolboy will begin algebra with the theory of substitution groups, as he might now but for inherited habits." We seem to be as yet very far from such a fundamental change in our courses in elementary mathematics, and the change is not likely to come until applied mathematicians make much more use of this theory. Two fundamental aspects of mathematics are idealization and actualization. As regards group theory the former concerns itself with a study of the structure and the abstract properties of groups, while the latter makes groups useful in the intellectual penetration of our actual surroundings in the physical world. The development of these two aspects of the subject seems to call for very different types of mind, and the latter naturally gives rise to the more extensive developments. It is in this field that group theory seems to be as yet in its infancy and hence one welcomes the more heartily such works as those of Professor Weyl.

In connecting group theory and quantum mechanics Professor Weyl directs attention to the fact that the former subject is in reality very old and may have been at the base of the early developments of ornaments, especially by the ancient Egyptians. He thus partly supports the view that the earliest developments in mathematics may have been inspired by a sense of beauty and harmony as exhibited in symmetrical geometric figures, and that when Euclid wrote his "Elements" the fundamental concept of group was so fully ingrained in the minds of the people that Euclid did not regard it as necessary to mention it explicitly. The emphasis which it began to receive during the nineteenth century is so marked that the late Felix Klein regarded it as the most characteristic feature of the mathematical developments during this century. Its essence is a study of a few fundamental laws of mathematical operations, and it has created for itself a marvelously rich but isolated mathematical universe which has proved to be very attractive to a number of pure mathematicians, who are accustomed to ignore their actual physical surroundings in their intellectual activities and to study ideal situations.

While the applied mathematician is not accustomed to such isolation and hence can not be expected to enter with as much enthusiasm as the pure mathematician upon the study of the particular laws involved in group theory, yet he seems to realize more and more that the actualization of such a rich store of abstract mathematical knowledge is likely to extend his insight into our actual physical surroundings. Hence it seems reasonable to expect that in line with the work noted above more and more frequent use of group theory will be made in the future by applied mathematicians, but that some of the most optimistic statements relating to this use will not be realized in view of the fact that those who are continually reminded of laws which are not considered in group theory will be more forcibly impressed by its limitations than the idealists.

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## THE MOVEMENT OF SAP IN PLANTS

VERY great interest has been roused in Europe and America by the striking researches and discoveries of Sir J. C. Bose on the unity of physiological mechanism in the plant and in the animal. After the conclusion of his lecture at the University of Vienna, Sir J. C. Bose was kind enough to lend me his instruments for the repetition of his more important experiments in the institute of plant physiology of the university. As this is the first time that his

[1] *Bulletin of the American Mathematical Society,* 3: 107. 1893.