sion that the Society of American Bacteriologists will hold their next annual meeting at the University of Michigan.

ON the invitation of the secretary of the Smithsonian Institution, Dr. Charles G. Abbot, and of the assistant secretary in charge of the U. S. National Museum, Dr. Alexander Wetmore, the third annual meeting of the American Association of Physical Anthropologists will be held at the U. S. National Museum, March 21, 22 and 23. This meeting will give opportunity to see or review the extensive collections of anthropological and comparative material acquired by the National Museum. For the benefit of more distant members who belong to the American Association of Anatomists also, the date of the meeting has been arranged to facilitate attendance at both conventions, the anatomists meeting in New York on the three succeeding days.

A CORRESPONDENT writes: "Over five hundred members have already enrolled for the sixth international Congress of Genetics. Many of these have done so recently. Because of the past uncertainty of holding the congress, it seems probable that there are many other individuals who, now that it has been definitely decided to go ahead, will wish to join as soon as possible. For this reason the council has decided to extend the date for ten dollar memberships until May 1. After that date, the membership will be at an increased fee ($12.00). Graduate students and assistants may join as six-dollar members until May 1. After that date their memberships will be at the rate of seven dollars. Both of these revisions have been made because of the exceptional economic conditions and because the council is anxious, in so far as it is possible, to avoid having financial considerations a deterrent to memberships. The number of people who have already joined insures a representative and highly successful congress, and reveals as well the great amount of active interest in genetics at the present time. The guarantee that full proceedings will be published and that each member will receive a copy has proved to be a strong attraction, not only to geneticists but to many biologists in other fields."

MRS. HENRY LANG has presented to the Montclair Art Museum in memory of her mother, the late wife of Jasper R. Rand, who died in 1909, an addition, built at the cost of $100,000, devoted to an exhibition of American Indian material.

DISCUSSION

DEFINITION OF A MATHEMATICAL GROUP

IT is just about a century ago that the word group began to be used as a mathematical term by a young Frenchman named Evariste Galois, who died before he reached the age of twenty-one, but who had at that early age inaugurated such fundamental work that he is still ranked among the 25 greatest mathematicians that ever lived and the only one among them who gained this eminence by work accomplished at such an early age. Although the concept of group had been employed occasionally in mathematics before the time of Galois his new uses thereof were probably the most influential in the vast developments relating thereto, which took place during the hundred years just closing. It is well known that these developments are now extending into such subjects as mathematical physics, where they have sometimes been called a pest, and also into elementary mathematics, as may be seen from the fifty-one pages devoted thereto in the recently published volume on analysis of the "Enciclopedia delle Matematiche Elementari."

It may be appropriate to note here in connection with the termination of the first century of the use of the mathematical term group a few elementary notions relating to its definition without entering into technical details relating thereto, especially since widely different definitions of this term appear in standard works of reference. It seems to have been always assumed therein that the distinct elements of a group satisfy the two conditions that they include the product of every pair as well as the square of every one of them. In many cases the elements are such that no other condition is necessary in order that they must constitute a group even in the most restricted sense of this term. This is true, for instance, when these elements are the permutations with respect to which groups were first studied by J. L. Lagrange, P. Ruffini, E. Galois and others. It may therefore be of interest to note here the circumstances under which one of these two conditions implies the other as regards a given set of such elements.

It is easy to see that the latter of these two conditions implies the former only in the trivial cases when the group is either the identity or of order 2. That is in every other group it is possible to find a set of distinct generating elements so that the set includes the square of each one of these elements but not the product of every pair thereof. On the contrary, the former of these two conditions implies the latter with very few elementary exceptions. One such exception is furnished by the set composed of the identity and the six elements of order 4 of the quaternion group. It is easy to verify that the set of seven elements thus obtained includes the product of every possible pair

of its distinct elements but not the square of its elements of order 4. Since the quaternion group plays such an important rôle in the history of mathematics it is interesting to note that it is the only non-abelian group which involves a set of generating elements such that they satisfy the former of the two given conditions without implying the latter.

Among the abelian groups it is obvious that every cyclic group contains such a set of two operators composed of a generator of the group and the identity. When the order of a cyclic group exceeds 2 it also contains such a set of three elements composed of a generator, its inverse and the identity. When a group involves only elements of order 2 besides the identity, all its elements of this order constitute such a set. As these elementary groups are the only ones which separately involve such a set it results that when a set of distinct group elements satisfies the conditions that it includes the product of every pair of these elements and does not generate one of these elementary groups it must also involve the square of each of its elements and hence constitute a group. Since the properties noted above lie at the very door of group theory they should be of interest not only to those who desire to enter therein but also to those who wish to know only where this subject abides and whence its growing influence emanates.

G. A. MILLER

UNIVERSITY OF ILLINOIS

AUTHORS' ABSTRACTS[1]

DR. LAMSON, and other readers of SCIENCE, may be interested to know, in connection with Dr. Lamson's article on *Biological Abstracts* in SCIENCE for November 13, that the principle of having authors' abstracts accompany all geological publications has been accepted by geologists.

A motion asking that the International Geological Congress recommend such abstracts was presented, by a representative of the division of geology and geography of the National Research Council, at the fifteenth session of the congress, which met in South Africa in 1929, and was passed by the congress. A year or two before that, authors' abstracts were called for in all publications of the Geologic Branch of the U. S. Geological Survey, and a committee of the branch prepared a set of suggestions for authors of abstracts. The plan of having authors' abstracts in the publications of the various state geological surveys has also been presented to the state geologists in their annual meeting and approved by them. A memorandum calling for authors' abstracts in publications of all branches of the U. S. Geological Survey has just been issued. In two geological publications, the *Journal of Geology* and the *Bulletin of the American Association of Petroleum Geologists*, authors' abstracts accompany almost all papers. Authors' abstracts of all papers to be presented at the annual meeting of the Geological Society of America are distributed before the meeting and printed in the annual volume.

As far as actual accomplishment goes, these results are still far from covering the field of geological publications. The action of the International Geological Congress is not binding in any way; it is merely a very valuable step in the promotion of the project. It has, however, created interest in the idea in other countries and led to its adoption by a number of important publications.

That ultimately the idea will be generally accepted in scientific publications can scarcely be doubted. The additional percentage of time required for an author to prepare an abstract of a paper which he has just completed is so slight that the only objection there can be to it is the additional bother; but when authors generally have fully realized the growing impossibility of keeping up with the flow of scientific literature, the unfairness of burdening their more public-spirited colleagues with the preparation of an abstract of another's paper, and the value to themselves of an abstract as a means of bringing before their busy colleagues the essence of their publication, they will be not only willing, but eager, to prepare the best possible abstract.

Biology and chemistry have perhaps solved, even under present conditions, the problem of covering with abstracts the entire field of their interests. But it is hard to believe that when those more public-spirited members of these professions, who prepare the abstracts, once realize the needlessness of their self-sacrifice, they will submit indefinitely to being made the goats. It is true that not all authors, at present, know how to prepare good abstracts of their own papers. Some authors find it hard to write an abstract much shorter than the original paper; but a study of abstracts indicates that the majority of authors' abstracts are too short and too incomplete. Either type of defect may be due to insufficient effort as well as to inexperience. But it is worth while to point out another peculiar psychological twist which leads to inadequate abstracts; that is, that some authors, in preparing abstracts, have in mind, often unconsciously, to conceal from the reader as far as possible the conclusions arrived at and, by merely indicating the subject-matter with which the paper deals, to lead the reader of their abstract to read the paper itself. If they knew how often this ruse fails they would probably soon abandon it.

Under paragraphs (1) and (2) of his discussion of the possibilities of carrying out the plan of having

[1] Published with permission of the Director of the U. S. Geological Survey.