fifty years ago there was still such a wide-spread lack of clarity as regards the notion of group on the part of some of the most eminent mathematicians of the day. The same volume which contains the mentioned remarks by Felix Klein contains also the modern postulates with respect to an abstract group by H. Weber (1842–1913) so that darkness and light relating to this concept are here closely associated.

Neither Sophus Lie nor Felix Klein ever adopted the modern postulates for an abstract group in their writings and in volume 1 (1926), page 335, of his "Vorlesungen über die Entwicklung der Mathematik" the latter remarked that the definition of group based on such postulates is very well suited for instruction and for a clear development of the subject but not for the discovery of new ideas and new methods. He stated on the same page that both he and Sophus Lie in their early work in group theory assumed only that the product of every two of a given set of elements is in the set in order that the set is a group but that Sophus Lie found it necessary in his later work to explicitly assume also that the set includes the inverse of each of its elements as a part of the definition of the term group.

On the contrary, the group theory postulates of H. Weber, or their equivalents, were at once taken very seriously in America, largely on account of the very successful works on algebra which he published and which contain these postulates. Various attempts were made in America to obtain more useful sets of postulates. As regards group theory these efforts were conducive to caution so that the laws or commandments as regards the concept of group were not transgressed but they did not lead to any great advances within the subject itself. The dilemma of Sophus Lie and Felix Klein to which we referred above was due to the fact that in their early work they had tacitly assumed that it is unnecessary to restrict the group concept to sets of elements which always include the inverse of each element but that they later abandoned this idea.

It is questionable whether any publication contributed more than Felix Klein's Erlangen Programm towards making the subject of group theory widely known and highly appreciated. It was translated into Italian (1890), into French (1891), into English (1893), into Polish (1895), into Russian (1896) and into Hungarian (1897). Nevertheless, according to Felix Klein's own statement it contains an inadequate definition of the group concept but one which includes its most effective elements. Those who later refined this definition also made valuable contributions towards the advancement of this subject, but their work naturally received less extensive attention. Great mathematical progress was frequently made by those who failed to observe pitfalls which their successors carefully labeled and which too frequently engrossed their attention.

G. A. MILLER

UNIVERSITY OF ILLINOIS

PENTHESTES AND CALOPHYA

THAT black-capped chickadees are making a substantial part of their winter diet on "jumping plant-lice" along the Connecticut shore may interest zoologists; that the psyllids are found upon sumac may interest botanists; and that *Calophya flavida* in its present nymphal stage abounds on *Rhus glabra,* while *Calophya nigripennis* abounds on *Rhus copallina* may interest ecologists. The two species of sumac, growing in close admixture, carry only their proper species of psyllid, never the other one. Dr. Oman, who determined the psyllids for me, informs me that only these two species of *Calophya* are known to occur in eastern United States.

Early this winter, 1941–42, I observed chickadees feeding freely on the very abundant sumacs of this region, interested not only in the fruit clusters but also picking minute objects from the stems of these shrubs, both low down near the ground and higher up. With field-glasses permitting very close-up work I saw that they took these from areas surrounding leaf-buds also from areas close to forks in the branches primarily. With a hand lens I examined the areas the birds had just worked, and found plenty of the beautifully sculptured nymphs. Those of *C. flavida* are darker and larger and have more marginal setae than nymphs of *C. nigripennis.* The numbers of both species are diminishing, under the attacks of the chickadee, as winter progresses. The birds are also feeding on many other animal and plant foods. Had their stomach contents been examined the nymphs might never have been recognized and determined, except as pulp of animal origin.

RALPH E. DANFORTH

NOANK, CONN.

DEGREES AT ANY TIME: BRAIN CONSERVATION

IN a recent number of SCIENCE[1] the writer discussed the importance of a twelve-month college year to insure earlier completion of curricular requirements. This was prompted by the frequently expressed desire in various quarters that students have the opportunity to complete their collegiate education before reaching draft age. It was pointed out that the plan was desirable not only in war-time, but that it was a good peace-time idea. Just as the article on the twelve-month college year was a long postponed sequel to a post-World War I article,[2] so the present discussion

[1] A. Silverman, SCIENCE, 95: 192, 1942.

is a sequel to an earlier article.[3] While the nation is in need of specially trained men of all capacities, it particularly wants the service of leaders and thoroughly dependable workers. Whether continuous instruction is afforded through the twelve-month college year or we follow the traditional custom of granting a long summer vacation, it seems desirable to get away from educational policies which serve only the average student. At present most institutions expect students to graduate in four years. A few get through sooner by taking summer courses. There are superior students who might cover a required curriculum in a much shorter time. There are others who can not keep the average pace, and they fail. In the earlier article to which reference was made[3] the writer likens students to automobiles, asking whether one thousand automobiles starting from New York at a given moment could all be expected to arrive at San Francisco at the same time even if they were the same model of a given make. Failure of mechanical devices to accomplish uniform service suggests that human beings, whose variations are greater than those of machines, should hardly be expected uniformly to follow a schedule. The writer feels that many superior students, who are retarded by the average pace of their fellow students, lose ambition and slow up their efforts. Also, there is no doubt that the student who can not go the average pace often gives up hope and fails.

While the educational facilities and financial status of our colleges and universities will, in the majority of cases, not permit the plan which is proposed, it is worth looking forward to. Assuming an adequate and competent instructional staff, good library facilities and sufficient laboratory space, a student would be permitted to follow a plan or a curriculum under direction or guidance, but chiefly through self-education in the library and laboratory, to advance himself as rapidly as possible. The instructor should be available when the student requires conferences. Regularly scheduled lectures would be abandoned, and except for occasional inspirational lectures, the student would have to depend on himself and on conference guidance. No text-books would be assigned, but good texts and reading references might be suggested. Grades would be abolished, and the only criterion would be the satisfactory completion of the work done. When the courses required in a given plan or curriculum have been completed satisfactorily, instructors would certify students to the institution's registrar, and a degree could be conferred at this time. If the work has been done in a year and a half or two years, the student can either go on with graduate study or go into service—commercial, educational, governmental. The student who requires more than four years, in other words is slower than average, can go on for five or even six if necessary, and by that time satisfactorily complete his requirements instead of having failed and been deprived of a degree at the end of four years. He would deserve receiving one after all. Naturally there will be students who are incompetent. After a given time these could be asked to vacate in favor of the deserving. Each student who has satisfactorily completed the requirements for a degree is entitled to it. The majority may still require four years. Instead of "getting by" in some courses as students do at present, they complete every course satisfactorily. They are not dependent on lectures from professors and daily guidance by them, but become self-reliant. They do not walk on the crutches of the predominating educational system of our day, but possess self-confidence. The student's independent search of the literature and independent exploration of the laboratory technique develop an assurance which regularly scheduled and constant direction do not afford.

Advocates of the grading system and the appraisal of individuals on this basis might hesitate to abandon the idea of "quality in a fixed time" for "satisfactory performance in variable time periods." It is the writer's recollection that the psychologist considers satisfaction the result of successful accomplishment, and happiness dependent upon satisfaction. With this in mind the superior student or man of genius, the average student and the slow worker, all succeeding in their tasks, performing satisfactorily, could be happy in their own way instead of experiencing the anxiety which the present system must bring to many students.

The instructor, through personal contacts with individual students and the direction of their efforts, could readily ascertain whether a student's performance is satisfactory. Examinations could be given at intervals if necessary or a student might be subjected to comprehensive examination upon completion of a subject or group of courses. The student would be sent into the world of affairs as a rapid, keen thinker or worker, an average individual or as a slow but steady and dependable one. In any event he can render satisfactory service at the pace which he can go, and the world would have its genius encouraged and cultivated, its average man and its plodding but reliable servant. It would not be getting a ninety per center or an eighty per center or a seventy per center from the standpoint of quality of work done. All work would be of one hundred per cent. quality and the service would be rapid or slow, as certified when the individual graduates. Genius would not be curbed. The slow worker and average worker, learn-

[2] *Idem, School and Society,* 12: 80, 1920.
[3] *Idem, Industrial and Engineering Chemistry,* 16: 860, 1924.

ing how properly to master a task, could improve their pace gradually. We would conserve the most precious possession of man, the human brain.

All this would cost money. We would need larger libraries, larger faculties, more laboratories. Each student would want space where he could work at any time day or night. He would want a competent advisory force to afford him conferences when required. The investment should prove worth-while. Just now, we are particularly anxious to eliminate slipshod and irresponsible performance. We need dependable individuals and good performance. After World War II is won and we are accustomed to heavy taxes, we can devote a portion of the funds collected to "brain conservation."

ALEXANDER SILVERMAN

DEPARTMENT OF CHEMISTRY,
UNIVERSITY OF PITTSBURGH

QUOTATIONS

THE A.A.A.S. BULLETIN[1]

EVERY member of the American Association for the Advancement of Science will receive each month a new publication, of which this is the first issue. No formal subscription for it will be required of members of the association, for its cost to them is included in their annual dues.

Broadly speaking, the purpose of the *A.A.A.S. Bulletin* is to advance science which, of course, is the purpose of all the activities of the association. But the advancement of science has a continually expanding and changing meaning. When the association was founded science was classified largely as "natural philosophy" and "natural history." Since that time science has been divided and subdivided into numerous special fields. There are now more than a thousand scientific organizations in the United States and Canada.

With the expansion of science the needs for increasing avenues of publication have led to the establishment of many special scientific journals. There has not been, however, corresponding increases in the number of journals for science in general, nor have those in existence been able to increase appreciably, if at all, the number of pages they print per year. This has been true of *Nature,* SCIENCE and *The Scientific American.* Obviously the needs of the association for journals are much greater than they were thirty or forty years ago when it held only one meeting each year and had no divisions and fewer than half as many affiliated societies, and when its membership was only a fraction of its membership to-day.

As science becomes more and more specialized, it becomes increasingly important to maintain interconnections among its various fields. That this fact is realized by specialists in the fields of the natural sciences is proved by the numerous joint symposia of sections and societies that have been held at the meetings of the association. But to specialists in these fields the social sciences, generally speaking, have been regarded until recently as being in foreign lands. It has taken the shocks of war to teach men the now obvious fact that human beings are so interdependent that no group can isolate itself from the remainder, even on the lofty peaks of pure science. The association, with its sections in the fields of both the natural and the social sciences and with its many affiliated societies from both fields, is ideally constituted to furnish opportunities for exploring the interrelations of science and society.

Several times in the past scientists have largely failed to recognize the tides in human affairs which they themselves have created. For example, when Charles Darwin removed man from his lonely and barren pedestal of a special creation, his contemporaries did not realize that he had ascribed to man all the rich qualities that flow in the varied streams of life and all its possibilities for change. Now when the applications of science have removed all the physical barriers that have hitherto separated peoples from peoples, let not the fact escape scientists that they have opened the gates to both Paradise and Purgatory. Which shall be humanity's fate now depends in large measure upon the ideals with which they inspire the world.

In order that the association may function more effectively as an integrating agency for science and society during the war, after its close, and indefinitely in the future, this publication has been established by the executive committee. It enables the office of the permanent secretary to communicate directly with *all* the members of the association. This has been impossible, except by mail, because about sixty per cent. of the members receive SCIENCE and about forty per cent. *The Scientific Monthly.* Moreover, not many of the announcements that will appear in this bulletin will be appropriate for SCIENCE and none of them for *The Scientific Monthly,* both of which will continue to occupy the distinguished positions in American science that they have long held in the past. The

[1] Introduction to the first issue, March, 1942, published monthly by the American Association for the Advancement of Science. The Office of Publication is at North Queen St. and McGovern Ave., Lancaster, Pa. The Editorial Office is in the Smithsonian Institution Building, Washington, D. C. The names of the editors are not given.