grants-in-aid for educational research during the period 1956–59. In a chapter entitled "A decade of teaching by television," Hideya Kumata summarizes the available data on the use of TV in classroom situations. The basic finding, derived from almost 300 comparisons, is that there is no significant difference, in the overwhelming number of observations, in the amount of immediate information gained when students taught by television are compared with students taught under face-to-face conditions. Moreover, the same result holds true for the retention of subject matter. Superiority of television is reported more often in voluntary audience situations than in captive audience situations. Thus the differences are in motivations among audiences rather than in the fact of transmission.

Superiority of television is reported more often in the lower than in the higher educational levels, presumably because of the greater suggestibility of children. Attitudes toward television and toward the subject matter are of prime importance, for students learn less when they have a negative attitude toward TV, and the negative attitude increases with age and educational level. Moreover, measuring the intangibles of education—those aspects beyond mere assimilation of information—has not been adequately studied. Thus, there is now at hand an impressive body of data indicating that classroom television is no magical resource.

When radio was first developed, there were great hopes for its potential as an educational device. Radio never achieved a level commensurate with these hopes, but after a long rather dormant period, university radio has found an active role in the educational division of labor. The initial aspirations for television were even greater, and pressure for the success of television far exceeds that involved in the history of radio. The Ford Foundation has become a major pump primer in television; in universities and to a much greater extent in high schools and public school systems, extensive resources are being allocated. There is every reason to believe that television will have greater success as an educational medium than radio. In the decade ahead, given the tremendous expansion of public school enrollment and the great pressure on schools to expand their custodial and recreational functions, television will become an indispensable resource. But these research observations clearly indicate that television will find its role in the educational system not because of its over-all pedagogical superiority but because of the great pressures for economic savings which face the school system. When TV is used as a resource —as chalk, the blackboard, maps, and the field trip are used—it can apparently serve to augment teaching facilities. But the great danger lies in the possibility that the United States will develop a two-track system, in one segment of which television is used heavily as a mass recreational device.

Much less is known about the impact of educational television from the special stations that transmit to the general public. In the suggestive essay by Ken Geiger and Robert Sokol, "Educational television in Boston," it appears that there are two rather distinct audiences for educational broadcasts. One is a small group of college-trained and college-oriented people who consume educational programs as they would any other form of adult education. For a larger group of much lower educational background and, by implication, of blocked social mobility, the educational programs are transformed into a kind of entertainment or popular culture. Thus, the informal network of educational television stations broadcasting to the public at large may become, in effect, a competitor of the national commercial systems and offer a form of popular culture more compatible with fundamental American values than that currently presented by commercial stations.

Social and Psychological Consequences

While Schramm's research does not conclude that television is ruining or debasing our society, it is now impossible for the managers of commercial television to deny the social and psychological consequences of their medium. The further growth of educational television will be only a partial solution to the questions concerning "television and our children" raised by this study. Commercial television, because it fills so great a part in the lives of youngsters, will have to find its own formula. Competition between networks can hardly supply the basis, for such competition, in the struggle to reach the largest audience, more often debases content. Instead, self-regulation, standards set by the Federal Communications Commission, and active involvement by educational, parental, and civic associations become the instruments of social change. One has only to observe the experiments of the Canadian Broadcasting Corporation: limited funds and less pressure have produced a simpler but more satisfactory programming policy for children.

Schramm's research is also relevant for the development of educational television. If national policy continues to stimulate the growth of educational television stations, the result will be an important alternative to commercial television for the general public. Already there is evidence that commercial television is increasing its output of documentary and public service programs. Thus, competition of this kind will increase standards, if the educational stations are guaranteed an economic base of operation independent of the size of their audience. But the future of educational television depends on classroom use. The research completed to date is only the first step, in that exaggerated claims have been cut down to size. The next step is to study the consequences of educational television on the school systems, not merely on the individual student. What is the impact of television on the teacher? What new skills and techniques are required to integrate this teaching device into the school system? Does the faculty lose control of curriculum when elaborate television productions are introduced? Such questions become crucial if the potentialities of classroom television are to be realized without destroying the autonomy of the teacher.

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Plant Physiology. A treatise. vol. 1A, *Cellular Organization and Respiration.* vol. 1B, *Photosynthesis and Chemosynthesis.* F. C. Steward, Ed. Academic Press, New York, 1960. vol. 1A, xxvii + 331 pp., illus., $13; vol. 1B, xvii + 348 pp., illus., $12.

These volumes follow volume 2 in an intended series of six volumes. Volume 1A has three articles treating cellular organization and respiration; volume 1B treats photosynthesis and chemosynthesis in single articles. Two of the five articles deal chiefly with higher plants: these are "The Plant cell and its inclusions" by R. Brown (in vol. 1A) and "Energy storage: photosynthesis" by Hans Gaffron (in vol. 1B). The first of these is a reasonable treatment in the 126 pages allowed, but it is poorly illustrated for a subject chiefly

concerned with the appearances of structures. The Gaffron article on photosynthesis (272 pages) is thoughtful and very thorough; it well summarizes the rapidly advancing subject as of 1958. An advantage of a limited treatise on photosynthesis is that the myriad of early and less pertinent observations cannot be included.

The other three articles — namely, "Proteins, enzymes, and the mechanism of enzyme action" (74 pages) by Birgit Vennesland (in vol. 1A); "Cellular respiration" (105 pages) by D. R. Goddard and W. D. Bonner (in vol. 1A) and "Chemosynthesis: the energy relations of chemoautotrophic organisms" (40 pages) by M. Gibbs and J. A. Schiff (in vol. 1B)—are needed in a general treatise on plant physiology. Their essential content is drawn from the wider aspects of biochemistry and is very condensed. The article by Birgit Vennesland is interesting to read and is a reasonable integration of the action of enzymes in groups rather than separately. In a preamble the editor comments that understanding energy storage requires consideration of chemosynthesis as well as photosynthesis, which accounts for the article on chemosynthesis. Oxidation and reduction and electron transport through cytochrome systems are particularly well treated by Goddard and Bonner. Their discussion of pathways of fermentation suffers from terseness, as is so apt to be the case for this subject.

A general treatise might be assessed on the basis of its organization of the content of the subject, the selection of authors and their thoroughness and enthusiasm, the inclusion of the most recent material as well as classical aspects, and on being sufficiently vital to arouse interest. This series fully meets these criteria.

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Biology and Comparative Physiology of Birds. vol. 1. Alexander J. Marshall, Ed. Academic Press, New York, 1960. 518 pp. Illus. $14.

Birds have been used as research material by so many biologists and in so many kinds of investigations that the resulting literature has become voluminous and scattered to such a degree that it is a major task for any investigator to acquaint himself with the available data. Any attempt to bring together a critical, coordinated, modern synthesis of large segments of these fields of study is therefore apt to be welcomed by the harassed zoologist. Indeed, Marshall first decided to undertake the preparation of this work because he himself was acutely aware of the time and trouble involved in gathering the information needed for his own researches. Once embarked upon this comprehensive survey, he found it necessary to enlist the help of some 23 highly competent colleagues in England, on the continent, and in the United States, Canada, and Australia. Of the 23, 13 have contributed chapters to this first volume (volume 2 is scheduled for publication shortly): "The origin of birds" by W. E. Swinton; "Adaptive radiation in birds" and "Classification" by R. W. Storer; "Geographical distribution" by D. L. Serventy; "Development" by R. Bellairs; "The integumentary system" by M. E. Rawles; "Skeleton" by A. d'A. Bellairs and C. R. Jenkin; "Musculature" by A. J. Berger; "Blood-vascular system" by J. R. Simons; "Respiratory system" by G. W. Salt and E. Zeuthen; "Digestive system" by D. S. Farner; and "Excretion" by I. Sperber.

Each chapter begins with a carefully worded introduction, which quickly and easily orients the reader to the viewpoints and guiding thoughts underlying the presentation. After this comes a series of subheads (the number varies in the different chapters from a minimum of 3 to a maximum of 18) and finally a useful and well-selected list of literature references. It is somewhat invidious to single out special chapters for mention, but just as an example of the convenient subdivisions in which the factual matter is presented and discussed, we may take the following two. In the chapter devoted to adaptive radiation, the breakdown is as follows: introduction; problems in size, the surface-volume ratio; locomotor adaptations; feeding adaptations; adaptive radiation within families of birds; the history of adaptive radiation; references. The chapter on respiration includes: introduction; anatomy; ventilation of the respiratory tract while standing; the regulation of respiratory movements; heat regulation by the respiratory system; respiration during specialized activities; references.

The chapters vary in the amount of detailed information presented, but all seem to be not only adequate but decidedly useful and reliable digests and guides.

The book is designed not only for ornithologists but also for general biologists who may want information about a given topic in avian biology. It can be recommended heartily to both groups as a reference work and for browsing. Two indexes, subject and author, complete this notable volume and make readily available the vast number of topics surveyed in it.

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British Cup Fungi and Their Allies. An introduction to the Ascomycetes. R. W. G. Dennis. Published for the Ray Society by Quaritch, London, 1960. xxiv + 280 pp. Illus. + plates. 80s.

The author has brought together, in excellent fashion, an account of the Ascomycetes of England, of which the cup fungi form an important part. The book is issued as Number 143 of the Ray Society series (a series of impressive scientific books in many fields published since 1844. A similar work on the Ascomycetes of North America has never been published.

An introductory chapter covers effectively such topics as fungi in general, structure and classification of the Ascomycetes, taxonomy and nomenclature, and techniques recommended for those who wish to collect and study these interesting organisms. The body of the text presents concise, accurate descriptions of each order, family, and genus involved, with effective keys for their ready separation. Species are not keyed, but they are carefully, though briefly, described with emphasis necessarily on microscopic characters.

The outstanding feature of the book is to be found in the illustrations, which are from the collections of the Royal Botanic Gardens at Kew. Nearly 500 species are depicted in the 40 colored plates and more than 150 others in black-and-white plates. Even though it is restricted geographically, this book will be very useful to all who are concerned with the Ascomycetes, for a great many of the species included are of world-wide distribution.

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