Plant Science: Report from China

Botany in China. Report of the Botanical Society of America Delegation to the People's Republic, May 20–June 18, 1978. ANITRA THORHAUG, Ed. United States–China Relations Program, Stanford University, Stanford, Calif., 1979 (available from Missouri Botanical Garden, St. Louis). xii, 154 pp. Paper, $7.50. United States–China Relations Report No. 6.

On 20 May 1978, ten members of the Botanical Society of America met in Hong Kong and set out on a four-week tour of Chinese botanical institutions, the first visit of its kind since the cultural revolution. The report they have jointly authored conveys the sense of momentousness they felt. Not a moment was to pass unrecorded; every place, every scientist, every discussion was to be noted, and, throughout, the visitors weighed up the likely bias of every crumb of information received.

They were clearly impressed. They were met with cordiality and a positive interest in collaboration. Their questions were answered with candor; and they were convinced that a balanced insight was gained into the state of Chinese botany. They concluded that, though their Chinese colleagues have been cut off from centers of research in the West for the last 30 years and compromised by the depredations of the Gang of Four, the science is now expanding again with vigor, determination, and ingenuity.

The delegates visited 36 institutions in eight cities and met 300 plant scientists and administrators. They reported, as far as they could, on the size, facilities, work conditions, and level of instruction and research in each. One gains from their report that research institutions and universities are generally poorly equipped, that libraries have frequently been neglected or destroyed, and that, though most institutions are highly staffed, standards are uneven. The numbers of students were still generally low at the time of the visit, but rapid increases were expected. The visitors were particularly impressed with the high degree of integration between the work of scientific institutions pursuing applied research and activity in the communes.

Systematic botany has again recovered its high status in Chinese botany. The ambitious Flora of China is making good progress again, and provincial floras are being published concurrently. The state of herbarium resources varied greatly from one institution to another, however, several having been disrupted by the cultural revolution. Lack of contact with herbaria outside China and shortage of literature must have hampered work and led to unnecessary synonymy, but there is a clear desire to break from the isolation. The emphasis given to floristic research by the utilitarian Chinese government reflects the ancient and continuing sophistication of Chinese ethnobotany, and in particular their extraordinary proficiency in herbal medicine. Curiously, pharmaceutical research receives scant attention in the report.

Close government control of research, combined with clear establishment of priorities, is manifested by an unfortunate repetitiousness in Chinese research, many institutions apparently pursuing almost identical work in isolation. This was particularly noticeable in crop research. Work on nitrogen fixation appeared to be the dominant priority in plant physiology, and anther culture for haploid breeding, the utilization of heterosis in self-pollinating crops, and the now well-known and controversial intergeneric hybridization are being pursued by a number of laboratories. The American botanists were impressed with results being achieved by the "three-line" approach in breeding rice, wheat, cotton, and sorghum. Here a male sterile hybrid is used to established a line, and maintainer and restorer lines are selected from superior cultivated strains; crossing between the male sterile and maintainer plants produces further male sterile hybrids, which are crossed in turn with the restorer plants to produce new fertile cultivars. The Americans were skeptical, however, about the degree of success claimed by some institutions in wide hybridization, initially between rice and bamboo, and later between various monocotyledonous crop genera and even wheat and pea. The first success was claimed by farmers during the cultural revolution and the work was subsequently pursued in research institutions, but no convincing examples were seen and several Chinese scientists themselves appeared unconvinced.

A variety of other fields are reported on to a lesser extent, including biochemistry, plant physiology, and cellular biology, paleobotany, marine botany, pollution ecology, and production of marsh gas.

Clearly, opportunities for collaboration between Chinese and American botanists are increasing, but there is a real danger that an uncoordinated rush of initiatives will lead to renewed difficulties. Interchanges are therefore wisely being handled through a steering committee established for this purpose by the Botanical Society.

PETER S. ASHTON
Arnold Arboretum,
Harvard University,
Cambridge, Massachusetts 02138

Memory as Cognition

Memory Organization and Structures. Papers from a conference, Lancaster, Pa., March 1977. C. RICHARD PUFF, Ed. Academic Press, New York, 1979. xviii, 412 pp., illus. $27.50.

In 1970, Gordon Bower began a paper with the sentence: "A modest revolution is afoot today within the field of human learning, and the rebels are marching under the banner of 'cognitive organization.' " Two years later, the revolution was thriving, as evidenced by the collection of papers *Organization of Memory* edited by Tulving and Donaldson. Today, the cognitive approach dominates the field; associative theorists, particularly those investigating the recall of word lists, are subjected to second-class treatment. The book that is the subject of this review attempts to document the gains of the revolution. The volume comprises 12 papers. An excellent paper by James Voss contrasts the organization view of memory with the association view that it is meant to replace, giving reasons for transforming the rememberer from the 1950's passive associator of stimuli and responses to the modern active organizer of information. Voss also briefly reviews recent work on discourse processing.

A portion of the remaining chapters continue themes that were well represented in *Organization of Memory*. Among the topics discussed in these chapters are the measurement of organization, particularly in free recall, and the

importance of the relationship between the organization imposed on material at the time of study and that imposed at the time of test. These themes are so well worked that they are no longer revolutionary; discussions of them appear many places other than this volume. However, Michael Watkins does provide a good description of differences among retention tests in the cues that they provide for remembering, and he discusses ways that manipulations of cuing can be used to specify what is remembered. Battig and Bellezza present data to show the importance of organizational processes for a levels-of-processing framework of memory.

Battig and Bellezza complain that there has been a decline in organizational research over the past few years. Rather than declining, it seems to me that the focus of this research has shifted from the recall of lists of words by college sophomores to other aspects of organization. Questions have been refined, and a greater variety of tasks and materials have been employed in research. One important development, a more careful consideration of different forms of organization, is discussed in a paper by George Mandler. Another interesting development is the increasing reliance on organizational processes to describe the memory of children. Research on this topic is reviewed in a paper by Ornstein and Corsale. Perhaps the greatest changes in the last decade have been the focusing of research and theorizing on semantic memory and the attempt to analyze tasks that appear to be ecologically valid. Janet and Roy Lachman offer an evolutionary perspective and review theories and data relevant to the organization of semantic memory. In the paper that is my favorite of the collection, Jean Mandler provides an excellent discussion of schematic organizations and their application to the recall of stories and scenes.

The organizational view of memory continues to be an approach rather than a theory. As one indicator of disarray, the authors of the papers could not decide whether "organization" and "structure" (two words that appear in the title of the book) are synonymous. Organization is more easily specified and, perhaps, is better investigated by putting it in the confines of a particular task that is of real interest than by trying to find general laws of organization that extend across all tasks, as seems to be the goal of some of the papers included in this volume. The papers provide good reviews of a number of subjects of research and should be useful for the novice. Although a few of the chapters are likely to also be useful for the expert, by and large the expert could as well spend the time reading the journals that have probably been accumulating on his or her desk.

LARRY L. JACOBY
Department of Psychology,
McMaster University,
Hamilton, Ontario, Canada L8S 4K1

Differentiation in Prokaryotes

Developmental Biology of Prokaryotes. J. H. PARISH, Ed. University of California Press, Berkeley, 1979. xii, 298 pp., illus. $48.50. Studies in Microbiology, vol. 1.

In the not-too-distant past it was customary to justify research on differentiating prokaryotes by claiming that whatever insight was gained would be of crucial importance in understanding development in higher organisms. An important premise of this argument was that gene regulation in all organisms is essentially the same (that is, if you understand the *lac* operon you understand *Escherichia coli*, and if you understand *E. coli* you understand eels and elephants). It has now become clear, however, that the assumption of the universal simplicity of regulatory mechanisms is no longer tenable. Understanding the workings of the *lac* operon only begins to prepare one for dealing with the arabinose-utilization operon or the tryptophan biosynthetic operon, let alone for dealing with regulation of messenger RNA (mRNA) processing, stability, and transport or control by translational discrimination, protein degradation, or DNA rearrangement. In this atmosphere *Developmental Biology of Prokaryotes* is a welcome addition to the literature. Its contents provide clear evidence that systems of differentiation in the microbial world are worthy of intensive study, whatever their potential value as models, because of their intrinsic interest as systems of biological interactions. Such interactions, highly varied and each intriguing, beg to be understood at the molecular level. The fact that easily cultivatable unicellular organisms, many of which are amenable to genetic analysis, carry out such diverse patterns of morphological and biochemical differentiation should be a stimulus to molecular biologists to exploit these systems.

In assembling this volume J. H. Parish has chosen to define development in its least restrictive sense. Thus he includes a detailed review by W. D. Donachie of cell division in *E. coli*, on the grounds that any morphological change, including septum formation, qualifies as development. Having chosen this course Parish might have opted to include a review of phage infection as well, since phage regulatory mechanisms leading to a temporal sequence of gene expression are especially well studied.

Endospore formation is the subject of two chapters. R. S. Hanson surveys spore structure, offers informative data on the diversity of spore-formers, and speculates thoughtfully on the role of spore formation in natural environments. G. H. Chambliss follows with a simplified but clear statement of unresolved issues in the study of the initiation of sporulation and of possible molecular mechanisms involved in the response to nutrient limitation. He has been victimized, however, by the long lag time between the writing of the chapter and the publication of the book. Thus, model experiments on control of nitrogen metabolism operons in Gram-negative bacteria, to which he refers, are no longer interpreted as he describes. In dealing with the mechanisms responsible for the changing pattern of mRNA synthesis during sporulation in *Bacillus subtilis*, Chambliss presents a well-thought-out and balanced account of what is known. Recent results with transcription of cloned DNA in vitro support the thesis he favors.

K. F. Chater and M. J. Merrick review intelligently and cautiously the current state of knowledge of *Streptomyces* differentiation. In addition they provide a nice rationalization for the complexity of morphological changes in this organism and speculate appropriately on the role of antibiotic production.

In a beautifully constructed review, M. F. Thomashow and S. C. Rittenberg document what is known about the biology of *Bdellovibrio*, an intracellular parasite. Their clear statements based on reasonably detailed information allow the reader to become well versed in a difficult subject. A particularly intriguing aspect of the *Bdellovibrio* system is that this obligate parasite, which normally grows within the periplasm of *E. coli*, can mutate in a single step to host-independent growth. Such mutations seem to turn on a large number of functions that can normally be supplied only by a host cell or a very concentrated bacterial extract. This suggests that *Bdellovibrio* has cryptic genes and opens the possibility that such genes are turned on by DNA rearrangement.

Other chapters review in detail the phenomenology of the developmental