book serves not only as an elementary introduction but leads successfully to a lucid treatment of many advanced and complex groups of investigations such as "Locating the breakage points in a translocation," construction of cytogenetic maps or the cases of complex heterozygotes (Oenothera).

An unusual feature of the book is the presence of itemized summaries of from one to three pages at the end of each chapter. These should prove very useful to the student. Numerous problems furnish an opportunity for applying knowledge gained from the text and also include additional information.

The book is not only centered around the chromosomal aspects of genetics but is devoted to it nearly exclusively. This results in an insufficient discussion of physiologic and of population genetics. Little space is given to human inheritance or to extranuclear transmissions. The treatment of Mendel's principles and of most other topics follows in general the scheme: (1) statement of theorem; (2) experimental proof. This enables the student to recognize the essential point immediately, but the reverse sequence, namely, (1) experiment; (2) deduction of theory, would have its merit too. While the information supplied is identical in both sequences, the latter seems better suited to convey the exciting pleasure of the discovery and organically makes possible a historical treatment with its humanistic implications. Altenburg does not neglect historical references but provides them as afterthoughts. Besides, the selection and omission of names of investigators is not free from subjectivity.

It is difficult to avoid errors in a first edition of a book which seems not to have been read critically in manuscript by colleagues of the author. A list of such errors has been placed at the author's disposal for use in later editions. For in spite of the criticisms voiced, this is an excellent book. There seems no doubt that Altenburg's "Genetics" will occupy a prominent place in the teaching of this subject.

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PLANTS AND CULTURE HISTORY

Plant Geography and Culture History in the American Southwest. By GEORGE F. CARTER. 140 pp. New York: Viking Fund Publications in Anthropology. 1945. $1.50.

IN this volume Carter has assembled a variety of data, archeological, ethnological, historical, geographical and taxonomic on the economic plants of the Southwestern cultures, has combined these with the results of his own research, and has drawn some far-reaching conclusions from the combination.

On the basis of the distribution, past and present, of cultivated plants Carter divides the agriculture of the Southwest into two areas—the Gila-Sonora and the Anasazi.

The Gila-Sonora area includes approximately the southern halves of Arizona and New Mexico, is associated with the Piman and Yuman cultures, is characterized botanically by the summer squash, *Cucurbita Pepo,* a single race of maize, tepary and lima beans, and cotton. Carter traces its origins directly to Mexico and regards it as relatively recent.

The Anasazi area represents the plateau agriculture which is associated with the Basket Maker and Pueblo cultures. It is characterized botanically by the cushaw type of pumpkin, *C. moschata,* the kidney bean and several types of maize, some of which show strong resemblances to those of the eastern United States. Carter regards the earliest culture of this area, the Basket Maker, as a peripheral development springing from an earlier eastern agriculture which had originated independently of Mexico and was based upon the growing of locally domesticated cucurbits and the utilization of seeds of Chenopodium, Ambrosia and Helianthus.

Carter's conclusions with regard to the Southwest have important implications for other regions. The first is obvious—if the earliest cultures in the Southwest have had their origins in eastern precursors then it follows that the latter must be considerably earlier than has commonly been supposed, perhaps, by Carter's reasoning, as early as Upper Pleistocene. A second implication is that domesticated plants (and by inference other cultural materials) have reached the region now the United States by two routes, one west Mexican, the other east Mexican or Caribbean. The third implication is that domestication of plants and the invention of agriculture have occurred in America independently again and again, indeed wherever plants suitable for domestication were available. Carter postulates four centers of domestication for *Cucurbita Pepo* alone.

To a botanist who holds the deep conviction that botanical studies of prehistoric plant material need not end with mere description, a first, cursory reading of Carter's book brings only delight. But further study raises serious doubts. Is the evidence adequate to support the important conclusions drawn from it? The evidence from maize, at least, is far from satisfactory. It deals with plant differences at a varietal or racial level. Progress has been made in recent years in identifying and describing the races of maize, but the problem is so complex, and intermixture between races is so wide-spread, that the conclusions which Carter has drawn from his studies of maize involve an appreciable element of doubt as well as one

serious error. Carter states that the earliest Basket Maker corn is uniformly flint in kernel texture, yet of the 33 ears found at the earliest-dated Basket Maker site, only 18 were classified by G. N. Collins, a maize expert, as flint. The evidence from the cucurbits is, in the final analysis, scarcely mere convincing —it is easily susceptible of more than one interpretation. The treatise suffers also from a failure to distinguish always between conjecture and fact—there is a tendency for the tentative hypothesis of one page to be treated as an established fact on another.

The archeologist is inclined to criticize even more severely. To him it seems that Carter has not only treated the published literature in archeology in a highly selective manner to create an impressive and forceful "one-way" argument in support of his hypotheses, but that he has also made some rather conspicuous errors. The assumption that "Basket Maker agricultural beginnings must lie either to the South, *i.e.*, among the Hohokam, or derive from some eastern source . . ." seems unwarranted on the basis of the known evidence. There is a great deal more than the Hohokam to the south of the Anasazi country as Carter defines it. Indeed the Hohokam cultures are largely restricted to the Gila Basin in Arizona and have only a limited spread.

Carter's discussion of geographical factors will seem peculiar to archeologists. In presenting his argument that agricultural plants and practices diffused into the Pueblo area from the Mississippi Valley he seems to ignore the known trade routes of Coahuila and the valleys of the Rio Grande, Pecos, Colorado of Texas and the Brazos; all covered in archeological discussions of prehistoric shell trade. In this same connection it seems unwise to ignore the cave material from Coahuila, the Upper Gila and Upper Salt, and other southern areas, which many students consider to be related, at least, to Basket Maker. On this point the archeologists must bear a share of the blame for slowness in publication.

The theory of the route through the Mississippi valley seems to be weakened also by the negative evidence of the Ozark caves. Carter presents the Ozark Bluff Dweller culture as representing the earliest agricultural stage in the eastern United States. Then he states that Basket Maker agriculture could not have derived from that.

In brief, his conclusions run counter to all archeological theory and evidence, and must therefore stand entirely on the botanical evidence.

Carter makes a strong point of the presence of ditch irrigation in the Hohokam area and its absence in the Pueblo region to the north. Here he is merely following careless statements in the general archeological literature of the Southwest. Ditch irrigation was practised in the Pueblo area and as far north as the Mesa Verde region of the San Juan in southwestern Colorado and southeastern Utah. Reservoirs and ditches were first noted in that country by Nordenskiold in 1893, and have since been described by others.[1]

The last section of the book is devoted to an argument for a great age of human cultures based upon the evidence from plant domestication. Here Carter makes use of a technique which he apparently denies to archeologists. In criticizing Gladwin's early dating of the Snaketown culture he says, "Gladwin's early dates are based on the theoretical time necessary for cultural developments which took place. This is obviously a risky means of arriving at a date." Archeologists will think that it is also a risky means of arriving at botanical dates.

Despite the criticisms which can be made of it the book still remains an important contribution and one which both botanists and archeologists will read with interest.

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[1] *Cf.* Guy R. Stewart and Maurice Donnelly, *Scientific Monthly*, 56: 1 and 2, pp. 31–44, 134–144, 1943.

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