MITOCHONDRIA IN PLANTS. II

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INTRODUCTION

Without minimizing the importance of the papers published during the past ten years on the subject of mitochondria in plants, it must be said that most of them are corroborative of previous work and suggestive in nature rather than definitive in any sense of the term. A few new interpretations have been made and some new techniques applied, but in general, the subject is still weighted with the incubus of an enormous early literature of confusing terminology and unsupported generalization which, by sheer repetition, have often achieved the status of dogma, and theories have far outstripped experimental evidence. It seems safe to say that there are at present no grounds for an attitude of poised assurance toward any of the theories put forward thus far concerning the nature and function of mitochondria in plants.

While it is doubtless an exaggeration to suggest that the solution of the problem of the functional significance of mitochondria will reveal the clues to all hidden problems or provide answers to all the questions concerning metabolism and heredity in the living organism, it is a truism to say that the problem does constitute one of the most important arcana in modern biology, and the cellular processes necessary for life will never be fully understood until the functional significance of mitochondria is revealed.

Recent findings in the fields of non-Mendelian heredity, viruses, enzymology and neoplasms have given a new urgency to the problem and have attracted many new investigators to the field. Thus the progress of the past decade, largely, however, by animal cytologists, but with techniques which seem equally applicable to plant cells, gives promise of an early solution to some of the questions about the function of mitochondria in the cellular economy.

1 Supplement to article in The Botanical Review 6: 85-147. 1940.
Since the mitochondria of plant and animal cells are generally regarded as homologous structures, it would seem that any new experimental technique or findings, whether based upon work with plant or animal tissues, would be of use and value to the plant cytologist. For this reason, some of the experimental work done by animal cytologists will be included in the present review. It might also serve to help break down the too rigid dichotomy existing between the sister disciplines.

To implement such a rapprochement, the reviewer would like to reiterate his plea (106) for a more definite nomenclature and for reduction to synonymy of the many terms occurring in the literature with reference to mitochondria in both plant and animal cells. It is proposed that the term "mitochondria" (mitos: thread; chondrion: small grain; singular: mitochondrion), coined by Benda in 1897, be retained exclusively on the grounds of priority, etymology, common usage and adequacy for our present knowledge of the subject. The term "mitosome", therefore, would logically refer to the thread- or rod-shaped mitochondria, and the term "chondriosome", to the granular forms. The term "mitochondriome" could refer, in a collective sense, to all the mitochondria in a cell or tissue. When in doubt that all the granules observed in the cytoplasm are truly mitochondrial in nature, the term "cytochondria", as used by Opie (109), might well be employed.

This terminology is at variance with that of Guilliermond and the French school who have written so many papers on mitochondria in plants, and may, therefore, need some defense. Guilliermond (71) uses the terms "chondriosomes", "chondrioconts" and "mitochondria" for our proposed mitosomes, mitochondria, and chondriosomes, respectively. Historically each of these terms was borrowed from Meves, Lewitsky and Benda, respectively, and, since they are etymologically arbitrary and incorrect, the terminology suggested in this review seems preferable from the standpoints of priority, etymology and simple clarity.

In plant cells the terms "proplastids" and "archiplasts" are generally accepted as referring to those elements of mitochondrial morphology which show evidence of starch or other secretions, and which, with the plastids, comprise the plastidome.

The literature of the past ten years will be divided into two