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1. Further studies of nucleic acids and allied compounds in relation to suppression of meiosis in ameiotic maize.

The preliminary biochemical studies on the action of the ameiotic gene controlling meiosis in maize (MNL 33) have been extended, and some results of further analysis have been briefly reported (Science, 1959). The present status of the findings will be summarized under four categories: (1) acid soluble precursors of nucleic acids, (2) ribonucleic acid or RNA, (3) deoxyribonucleic acid or DNA and (4) "histones." All investigations, so far, are limited to young ears and 3mm long root tips.

(1) Acid soluble precursors of nucleic acids

a) In young ears: As revealed by spectrophotometric analysis of the cold acid extracts from delipidated materials, there is an accumulation of precursors of nucleic acids in the ameiotic ears at all stages of development except at a very early stage much prior to megasporogenesis. In the materials from normal plants the concentration of the precursors is found to be low. This is probably due to a more rapid utilization of the precursors in the synthesis of nucleic acids in the ears of normal plants.

On further analysis the accumulating material is found to be some ribonucleosides. Chromatographic separation has indicated the presence of at least four different compounds in this acid soluble fraction. These have been tentatively identified as adenosine, guanosine, uridine and xanthosine. Uridine is in maximum concentration and xanthosine is in minimum.

b) In root tips: Precursors of nucleic acids have not been found in the extracts of root tips of ameiotic plants. It appears that the synthesis of the precursors is more rapid at the time of meiosis than at mitosis.

(2) Ribonucleic acid (RNA)

a) In young ears: Following a modified Ogur-Rosen and Schmidt-Thannhauser procedure an attempt has been made to fractionate different types of RNA (differing in their solubility behaviour and probably metabolically different). The fraction extractable with very dilute cold Perchloric acid will be called RNA-1 (may be polyribonucleotide of low molecular weight or SRNA of Hoagland); the fraction extracted with cold but stronger Perchloric acid will be referred to as RNA-2; and the acid resistant but alkali soluble RNA will be designated as RNA-3. It is found that there is an excess of RNA-1 in the ameiotic ears as compared with the normal ones. The quantity of RNA-2 is also greater in ameiotic ears, though the difference is not as big as in the case of RNA-1. Inference regarding RNA-3 has to be deferred.

b) In root tips: Difficulty of obtaining sufficient material has hampered an elaborate fractionation of RNA from root-tips. It has been, however, observed that the root tips of ameiotic plants contain more of acid soluble RNA (Ogur-Rosen and equivalent to the sum of RNA-1 and RNA-2; there may not be any RNA-3) than those of normal plants.

(3) Deoxyribonucleic acid or DNA:

a) In young ears: The DNA extracted by the Ogur-Rosen method is found to be contaminated with some RNA (RNA-3), because of the incomplete extraction of RNA from the ear material. After necessary correction for this RNA, the total amount of DNA expressed per unit fresh or dry weight of tissue is found to be the same for both normal and ameiotic material.

The earlier finding (MNL 33; Science, 1959) of a possible difference in the so-called apurinic DNA fraction obtained after a brief hydrolysis with dilute hydrochloric acid is being further analyzed in this light. Since the difference was indicated in the base composition of this fraction, an analysis of the base composition of RNA has appeared necessary.

The ratio of RNA/DNA is higher in the ameiotic plants than in their normal sibs.

b) In root tips: In the root material, however, the DNA extracted by the Ogur-Rosen method is found to be free from any contaminating RNA indicating thereby an absence of the acid resistant RNA (RNA-3) in root tips. The estimated values for DNA are found to be the same in the ameiotic plants and their normal sibs.

(4) "Histones" and other proteins:

a) In young ears: The estimation of proteins extractable by the Daly-Mirsky method for histone determination has given much higher values for ameiotic material. If this is a true measure of histones, then the histone/DNA ratio is about twice as high in the ameiotic ears. Besides "histones", there are indications for a higher level of other proteins in the ameiotic material and further analysis is in progress.

Values obtained for "histones" in the root tips are too low to be given any weight. These are to be redetermined.

These results permit attempting a tentative and unified scheme to explain the suppression of meiosis in ameiotic maize so as to guide the course of further work towards an understanding of the physiology of meiosis and the delicate balance between meiosis and mitosis. It appears that the gene partially blocks some step(s) in the conversion of ribonucleosides into deoxy compounds, thereby preventing their rapid incorporation into DNA and leading to their accumulation in the ameiotic ears. An increase in the concentration of these precursors would favour an increased synthesis of RNA, which in its turn would cause greater synthesis of proteins. Excess of RNA even in the absence of any accumulation of precursors as in ameiotic root tips and in the extremely early stage of ameiotic ears perhaps points to a second possibility, that the pathway for RNA synthesis is more active at all stages of development of the ameiotic plants, which may or may not be associated with a partial block of DNA synthesis.

For normal meiosis a critical balance between 1) DNA and RNA, 2) DNA and histones as well as other proteins, and 3) two different types of RNA (one metabolically more active than the other) appears essential. A high RNA/DNA, histone/DNA, and RNA-1/total RNA appears to favour mitosis and suppress meiosis.

-- S. K. Sinha

2. A preliminary biochemical study of the action of the 'asynaptic' gene in maize.

Encouraged by the results obtained from the biochemical studies of the "ameiotic" gene (MNL 33; Science, 1959), an attempt has been made to see if the gene "asynaptic" affects nucleic acid metabolism in some way. Only three young ears of asynaptic plants and three of their normal sibs have been