NOTE.

TELOSYNAPSIS AND PARASYNAPSIS.—There exists at the present time a considerable amount of confusion as to the actual nature of the controversial points which cluster, or are supposed to cluster, around the manner of pairing of the somatic chromosomes at meiosis, whereby the well-known heterotype chromosomes are produced. This confusion is due in great part to the attempts which have been made to crystallize the essential differences between two divergent schools of interpretation by the introduction of the terms Telosynapsis and Parasynapsis respectively.

But it must have become evident to every one at all conversant with the current work on mitosis, that however appropriate these terms may be to express a special mode of chromosome union, they have now become rather misleading to any one not familiar with the details of cytological advance within the last few years. The fact is, that by emphasizing a point of comparative unimportance, they have led to a misconception on the part of many people, as to the really fundamental differences which still divide the two schools of investigators.

Montgomery in America, and Farmer and Moore in England, working independently on very different material, came to the conclusion that the heterotype chromosome arose as the result of an end-to-end union—or a lack of disjunction—of a pair of somatic chromosomes. These paired chromosomes are arranged more or less in the form of an open loop, the sides of which they constitute. The familiar figures observed at diakinesis, and at still earlier stages, depend on the various ways in which the limbs of a loop behave as they approximate towards, or coil round, each other.

In formulating this explanation, the investigators above named were mainly influenced by the very common occurrence of loop-like figures at an earlier stage, which were also traced through succeeding phases; the turn of the loop was supposed to coincide with the point of union between the two somatic chromosomes.

The closer approximation of the sides of a loop was believed by the English authors to take effect at the stage called 'second contraction', a stage which, where it was discerned, appeared to be one of very short duration, and consequently is easily missed. It is obvious, however, that there is no essential difference between a lateral approximation achieved by the twisting together of the sides of such a loop, and an approximation produced by the coming together in pairs of chromosomes hitherto disunited, nor is it a matter of any importance whether the approximation occurs at a somewhat earlier or later period in mitosis.

The really vital question at issue between the two schools does not, as a matter of fact, consist in Telosynapsis *v.* Parasynapsis as etymologically understood, *but upon the interpretation to be placed on the much earlier stages of prophase* in the heterotype mitosis.

Investigators, represented in the first instance by Grégoire and his pupils, who hold the 'Parasynaptist' view, believe that the early so-called *longitudinal fission of the chromosomes* marks the union of the pairs of somatic chromosomes. Furthermore, they attach no importance to *second contraction*, which is interpreted by their oppo-

nents as concerned in bringing about this union. The 'Telosynaptists', on the other hand, regard this early longitudinal fission as a reality, and as indicating *precisely the same fission as is responsible for the bipartition of the chromosomes of a normal premeiotic or postmeiotic nuclear division.*

I endeavoured to put forward the main features of the whole position as plainly as I could in 1905:

'Thus the essential peculiarities of the meiotic¹ phase can be explained as follows: They are due to the coherence in pairs of premeiotic chromosomes and to the intercalation of a special form of chromosome-distribution during the course of what would not differ materially from an ordinary premeiotic mitosis. In the first of the two divisions, a distribution of entire premeiotic chromosomes is secured, and thus the number of these bodies is really halved. In the second division, the longitudinal division begun, but temporarily arrested, in the preceding prophase takes effect.'

I have never receded from this position, because it has always appeared to me that, in spite of the many differences in detail exhibited during meiosis in the various members of the animal and vegetable kingdoms, this interpretation harmonizes best with the observed facts, and also with what we have ascertained as the result of comparisons with the other mitoses in the same organisms. It has also materially gained in strength of late years, since improved technique has made it evident that in *somatic* mitoses the chromosomes are actually longitudinally split during the late telophase of the *preceding* division, and that in the succeeding early prophase each differentiating chromosome can be distinctly recognized as already consisting of two longitudinally arranged halves. This duality commonly becomes apparently, but only apparently, lost during the following period of rapid growth and change of form before the chromosome becomes arrayed, along with its fellows, in the equatorial plate. At this latter stage, as every one knows, the split appears, or rather reappears, and results in the separation of the respective pairs of daughter chromosomes. The proof that features precisely similar in this respect are present in the *postmeiotic* as well as in the premeiotic mitoses (first given by Dr. H. Fraser) effectively disposes of the suggestion that this 'early fission' might represent an abortive 'pairing of homologous chromosomes' in the vegetative mitosis. Furthermore, the results obtained by Miss Digby and others, showing that the 'early fission' at the heterotype mitosis is exactly similar to the 'early fission' of the preceding archesporial divisions, render it extremely improbable that a fundamentally different interpretation is to be placed on the two cases.

I have tried in this brief note to point out as clearly as possible what are the really outstanding differences which at the present time constitute the main points at issue between the 'Telosynaptists' and the 'Parasynaptists', inasmuch as they have been greatly obscured by the rather unfortunate names under which the divergent views are now so commonly classified.

J. BRET LAND FARMER.

THE ROYAL COLLEGE OF SCIENCE,
LONDON.

¹ In the original (Quart. Journ. Micr. Sci., vol. xlviii) the word was printed 'maiotic'.

Farmer, J. B. 1912. "Telosynapsis and parasynapsis." *Annals of botany* 26, 623–624. <https://doi.org/10.1093/oxfordjournals.aob.a089407>.

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