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On double fertilization in plants with premitotic type of gametes fusion

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Abstract

This paper provide additional data to an earlier work (Korobova, 1978) on the behaviour of nuclear structures at the time of fusion of male and female sexual nuclei.

The nucleus of the egg cell of *Scilla sibirica* is in interphase at the time of fusion (Fig. 1). The numerous delicate chromatine filaments form a radial pattern unfolding from the nucleolus and extending to the nuclear membrane. Each separate filament does not at the point of contact with the nucleolus, but forms a tightly coiled loop on its surface. Then the filament extends back to the nuclear membrane, forming several coils near it, and again returns to the nucleolus (Fig. 2). Each radial filament is only a small part of the much despiralised chromosome, because the number of these filaments is considerably greater than the number of chromosomes (n = 6). It seems that the loops of several, and possibly all the six chromosomes are in contact with the nucleolus.

The sperm nucleus has a quite different appearance; it is filled with thick, heavily spiralized chromosomes, and has no nucleolus (Gerassimova-Navashina, 1960, interpreted this state as telophasic).

When the sexual nuclei have drawn together (Fig. 3), the contacting areas of the membranes of both nuclei become disorganized and the nuclei fuse (Fig. 4). The zygote nucleus contains two clearly distinguishable chromosome complexes (male and female) which differ sharply by the degree of their spiralization. Later the male chromosomes gradually despiralize (Figs 5-7).

The telomeres of the male chromosomes are in contact with the nuclear membrane, while the entire body of each chromosome originally forms one single loop (Figs 9-14). On despiralizing, this loop becomes longer and finally comes into contact with the female nucleolus. There

is no evidence as to any specific functional meaning of this phenomenon. One can assume that the chromosome loops make sharp spasmodic movements at despiralization, because they are so twisted. All this takes place within a very limited space, therefore finally the continuously extending chromosome will, at a certain point, touch the nucleolus and hold fairly fast to its sticky surface.

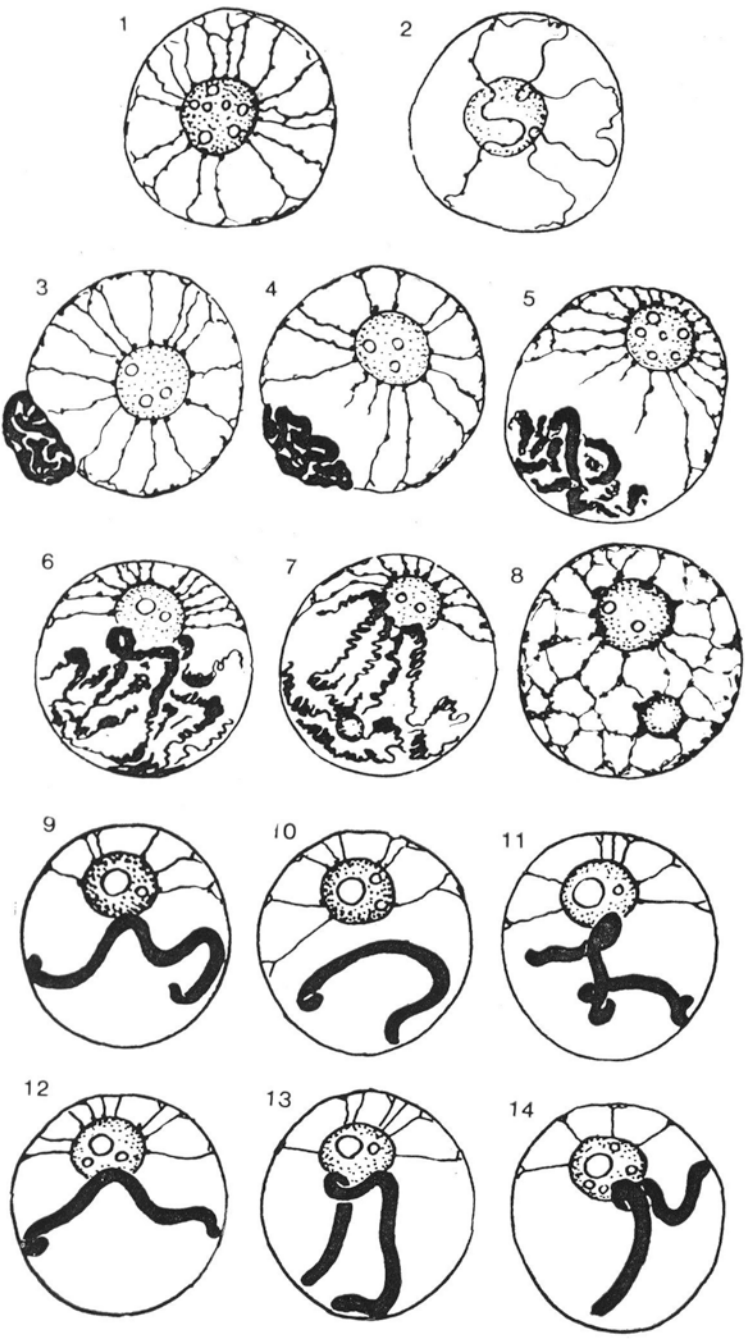
At a later stage, not only the telomeres but also other parts of the extending chromosome will, as it seems, come into contact with the nuclear membrane. Thus, each male chromosome, forms several loops. This process is hard to observe, because at that time male chromosomes become indistinguishable from female ones and at later stages, the chromatine filaments anastomose with one another, forming a mesh pattern (Fig. 8). The chromosome loops stick to the nucleolus and hold to it rather fast, although they can freely slide on its surface. As the female nucleolus shifts over to one side (Figs 4-7), the chromosome loops, remaining in cantact with it, at the same time move over to the other side opposite the sperm. The male chromosomes approach the part of the nucleolus already cleared of the female chromatine.

At the beginning of fusion, individual filaments (most probably loops) attached to the nucleolus the other end remaining free, were linked to the area of the female nucleus membrane which disintegrated during fusion of the nuclei (Figs 4-5).

Initially, the male chromosomes appear as a very compact mass and are undoubtedly connected only to the part of the membrane of the zygote nucleus which belonged to the sperm nucleus, (Fig. 4). But later the telomeres of the chromosomes can move apart to a considerable distance (Figs 6, 12). It is very likely that this happens by the expanding growth of the membrane between the ends of the chromosomes. It would then be natural to expect a considerable increase in the volume of the nucleus and the drifting apart of the ends of all chromosomes. This, however, is not the case. It looks as though the ends of the chromosomes move about somehow on the nuclear membrane without losing contact with it. This is in fully accord with the data furnished by some authors to the effect that the chromatine fibrils are structurally held to the inner nuclear membrane. The fusion of sexual nuclei in the central cell of *Scilla* proceeds in a similar manner (Figs 15-16).

Unlike *Scilla*, the sexual nuclei of *Zea mays* L. have very little chromatine. The much despiralized chromatine filaments are arranged near the nuclear membrane. Only 1 or 2 filaments come near the nucleolus. Most likely this is a nucleolar chromatine (Fig. 17). It is more difficult to discern each male chromosome in *Zea* than in *Scilla*. They are very highly despiralized and soon take on the appearance of female chromosome. Nevertheless, one or two loops can be traced in

Plate I.



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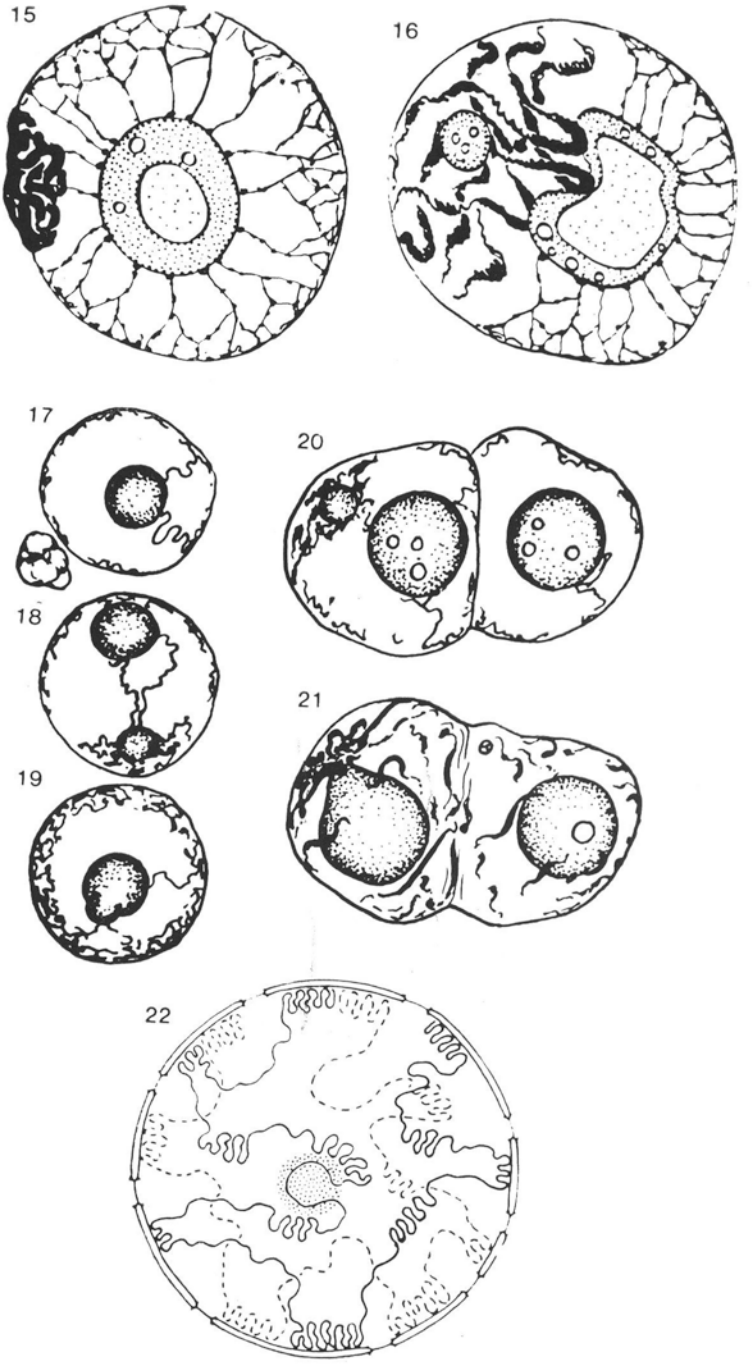

Descriptions in the text

contact with the female nucleolus which, just like in *Scilla*, is shifted away from the sperm (Fig. 18).

One might think that the loops of the female and male chromosomes in *Zea* are too short to reach the nucleolus, after the completion of despiralization and the establishment of their numerous contacts with the nuclear membrane. The short chromosome loops form a thin meshwork layer at the periphery of the zygote nucleus.

The separate male and female chromosome sets can well be seen in the prophase of the first endosperm devision in *Zea*. The male chromosomes appear in the process of spiralization precisely at the place (Fig. 21) where they despiralized earlier (Fig. 20). The interphase sexual (Figs 1-2) and somatic nuclei (Fig. 22, after Chentsov, 1978) are fundamentally similar in structure. In both cases each chromosome is linked to the nuclear membrane with its ends and some other parts forming loops which freely "float" in the nucleoplasm.

Contact with the nucleolus apparently depends on the formation of chromosome loops of sufficient length. Moreover, the length of these loops in sexual nuclei, most likely depends on the given species (Figs 1, 2, 22).

REFERENCES

Gerassimova-Navashina H., 1960. A contribution to the cytology of fertilization in flowering plants. Nucleus 3: 111-120.

Korobova S., 1978. Dynamics of nuclear structure in sexual cell at fertilization in *Scilla sibirica* Andr. Bull. Soc. Bot. France, Actualites Botaniques 125: 233-236.

Chentsov Yu. S., 1978. Obshchaya Citologiya. Moskva MGU.