

CYTOMYXIS

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WHILE making a study of pollen development in *Oenothera gigas* and *O. biennis*, Gates (3) frequently noted an extrusion of chromatin from the nucleus of one pollen mother-cell across plasma strands into the cytoplasm of an adjacent mother-cell. He considered this to be a normal process and called it cytomyxis. Since that time thirty or more cytologists have observed and reported these cytoplasmic strands and chromatic extrusions. A few of the early students considered the process to be normal.

Rosenberg working with *Drosera* (5), Sakamura with *Vicia* (6), Sinoto on *Iris* (7), Yasui with *Papaver* (10), Tischler with *Phragmites* (8), and Erlanson on *Rosa* (2) all think of this nuclear behavior as extremely abnormal and variously suggest that it is due to faulty technique in handling living material, to the action of the fixing fluids or even to pathological conditions. The present tendency has been to agree with the one or other explanation.

Several recent workers (Hicks 4, Church 1, Woodworth 9) who have been studying plant groups mainly from the standpoint of chromosome numbers and abnormalities of the reduction division with a view to detecting plants of hybrid origin, have paid some attention to cytomyxis especially when it involves chromosomes, chromosome groups, and even whole spindles. If such a transposition of chromosomes be normal and the cells in question could function in fertilization, the chromosome number in the gamete would be other than haploid. This would be of some genetic significance. It was thought to be important enough to stimulate further consideration of the normality or abnormality of cytomyxis.

Professor K. Sax has obtained some pertinent data concerning the nature of cytomyxis from a study of smear preparations of pollen mother-cells of *Secale* and other plants. Rye is especially good for such studies because if the end of the anther is cut off the pollen mother-cells may be squeezed out with little change in the normal arrangement of the cells. When such preparations are fixed and stained with aceto-carmin, or fixed in the usual fixatives and stained with crystal violet and iodine, there is little evidence of cytomyxis except at the late spireme stage. The spireme stages do show as high as ten per cent of the cells with chromatin connections but these cases are usually confined to the ends of the string of pollen mother-cells where the anther was cut or where it was pressed in removing the contents. At diakinesis one may occasionally find one or more bivalents which have passed into adjacent cells. At

metaphase and later stages there is no evidence of chromosome migration and the normal chromosome number and arrangement is found in practically all cells.

When the pollen mother-cells are squeezed out of the anther with enough pressure, or smeared with a flat needle after their removal from the anther so that the string of cells is flattened on the slide, "cytomyxis" is found very frequently. In fact under such conditions it is often difficult to find normal spireme stages. Most of the pollen mother-cells have distorted nuclei and chromatic strands between adjacent cells. This may also obtain at diakinesis when chromosomes are extruded into the cytoplasm, into adjacent cells, or into the fixing fluid where they are lost.

Some three hundred slides of the betulaceous catkins which were prepared and studied for chromosome numbers and peculiar behavior (Woodworth 9) were reëxamined for cytomyxis. The anthers which showed this protoplasmic continuity were usually in groups while the surrounding stamens, by far the majority in the catkins, showed no cytomyxis whatever. These aggregations of cytomyctic anthers appeared to be located either where the catkins were held between the thumb and forefinger when their sides were sliced off preparatory to dropping them into the fixing fluid or at a region where the razor blade passed through. The catkins were certainly not handled roughly but it seems that roughness of handling is a relative matter and that the pressure of holding and cutting the catkins must have caused the delicate mother-cells to expel some of their contents. The action of the fixative might contribute to these abnormalities initiated by pressure.

The above conclusion is substantiated by the fact that many species of *Betula* which showed cytomyxis have quite normal meiosis producing perfect pollen. If extrusion of chromatin, especially chromosomes, from one cell into another were a normal process it might reasonably be expected that the pollen grains would be varisized or even sterile in part.

As a check to the foregoing conclusion catkins of some of the species which showed cytomyxis were collected with great care to avoid pressure. These were imbedded and when sectioned showed almost no cytomyxis.

Hybrid plants which have considerable irregularity in the reduction division show the most extreme cases of cytomyxis wherein chromosomes and sometimes even spindles are transposed into adjacent cells. It would seem that some innate unbalance in the heterozygous protoplasm makes it much more susceptible to even slight pressures which would cause the extrusion of chromosomes.

Those students who have seen cytomyxis in the mother-cells of species of plants have not noted the subsequent phases of meiosis to have a deficiency or excess in the chromosome number of any of the cells as an effect of chromosome migration. The evidence now at hand strongly indicates that cytomyxis is not a natural process. Injury to the cells by pressure at the time of preservation seems to account for these cytoplasmic connections and chromatic extrusions.

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STUDIES IN GANODERMA

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Plates 29 and 30 and Text figure

INTRODUCTION

AMONG my field collections made in the summer of 1929 is a specimen of a *Ganoderma* from a fallen Spruce on an island in Remi Lake, northern Ontario. It is a normal fructification, annual, heavily laccate or varnished above, smooth and shining, rich reddish brown in color, laterally and rather stoutly stipitate. The stipe broadens at its apex, without demarcation, into the pileus; and both are alike in the characters just noted. The context is punky and rather tough, creamy white throughout, except close to the pores,



Woodworth, Robert H. 1931. "Cytomyxis." *Journal of the Arnold Arboretum* 12(1), 23–25. <https://doi.org/10.5962/p.185223>.

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