

**A NOTE ON AMITOSIS BY CONSTRICTION IN
SYNCHYTRIUM.***

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In a former article† dealing with amitosis in the parasitic fungus, *Synchytrium*, the writer mentioned beside the peculiar processes of direct nuclear division which he termed Nuclear Gemmation and Heteroschizis, a third sort of amitosis which resembles closely the more commonly reported process of amitosis where the nucleus elongates and divides by constriction or by the formation of a septum across it. Because he had observed only a relatively small number of such cases at the time of writing the former paper he contented himself with mere mention of the process. Since that time, however, a considerable number of such constricting nuclei scattered through a score of cysts have been found. From an examination of these cases the writer has been fully convinced that this is a normal process which is to be ranked along with the other methods of amitosis in multiplying the nuclei of the parasite preparatory to zoospore formation.

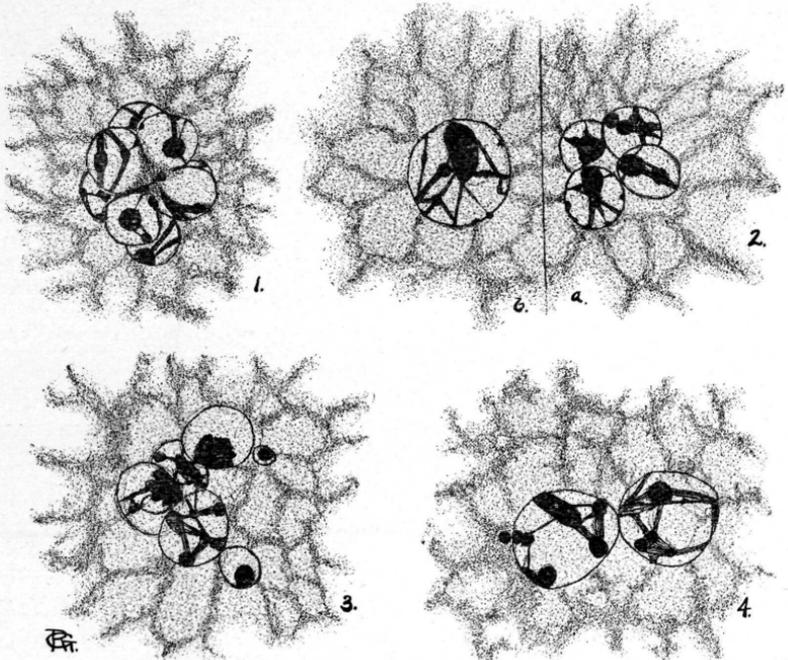
The mechanism by which amitosis is accomplished by constriction is as simple as could well be. Different parts of the chromatin of the nucleus separate and move apart, forming two or more lobes; these round off and each becomes an independent daughter nucleus. This process usually occurs in spirem, but in rare instances neither the daughter nuclei nor the remaining undivided nuclei in the cyst are in that condition. Amitosis by constriction occurs for the most part in early stages when nuclear gemmation is only just beginning and long before heterochizis is observed. Even the primary nuclei may divide in this manner though in the species studied, *S. decipiens*, they nearly always divide mitotically. Occurring thus early in the cycle of nuclear multiplication this process is usually but an incident in the history of the chromatin thus divided, for after a very brief existence the daughter nuclei are further subdivided by other sorts of amitosis (Figs. 3-4).

It is manifestly impossible to follow the history of the nuclei thus derived by constriction (or their chromatin content) further than their division which is usually accomplished by nuclear gemmation. But evidence was presented in the previous paper which shows that the small nuclei derived by that process are normal and become the ancestors of the zoospores which form

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the next generation. Inasmuch as healthy normal nuclei could not be formed from parents which were degenerating, that evidence applies to the parents as well as the descendants. In exceptional cases, where they do not immediately fragment, direct evidence of the fate of these nuclei due to amitosis by constriction can be secured. A few clusters of such nuclei have been observed to persist unchanged until mitosis began. When this occurred they did not behave differently from the other nuclei in any respect but formed spindles like them. In so far, then, as the power to divide by mitosis is a test of the condition of a nucleus, the products of this sort of amitosis must be regarded as normal and similar in all respects to those, if there be any such, which have descended by an unbroken line of mitoses.



In the formation of these nuclei there is apparently no opportunity for the chromatin to be exactly equatorially divided as in mitosis. An inquiry into the number of chromosomes occurring in mitoses following such divisions becomes therefore of primary interest in view of the great importance now being accorded to the number of chromosomes in our theories of heredity. In studies along this line which the writer hopes to publish shortly he expects to present evidence indicating, that in spite of the

apparently random division of the chromatin in amitosis the number of chromosomes in the species studied is constantly four. Moreover, in some of the spindles in clusters of nuclei undoubtedly formed by amitosis, the same number is clearly shown. The bearings of these observations except as they tend to demonstrate that amitosis by constriction is a normal process may, however, be left for discussion in the fuller paper which is to follow.

The figures are camera drawings made with 1.5 mm. objective and an ocular 12. They are enlarged 2130 times.

Fig. 1. A large nucleus constricting into a cluster of nine or ten daughters.

Fig. 2. (a) A cluster of daughter nuclei, constriction complete. (b) One of the adjacent parent nuclei of the same cyst.

Fig. 3. A cluster similar to Fig. 2, but beginning to give off small nuclei by nuclear gemmation.

Fig. 4. A similar cluster of two daughter nuclei.
