

those published here. Sax⁷ has recently given an account of the varying agents (X-rays, temperature changes, chemicals, genes, ageing, etc.) which are known to affect nuclear division after division of the chromosomes. He points out that in most cases the irregularities seem to be similar and appear to be effected by disturbing the synchronization of nuclear and cytoplasmic activities. This disturbance may in some cases at least be of the kind inferred above.

To what extent permanent structural changes can be attributed to breakage in hampered anaphases remains yet to be studied.

HOLGER KLINGSTEDT.

John Innes Horticultural Institution,
Merton, S.W.19. Feb. 14.

¹ Dobzhansky, *Z. Zellf. u. mikr. An.*, **21**, 169 (1934).

² Darlington, *J. Gen.*, **33**, 465 (1936).

³ Janssens, *La Cellule*, **37** (1924).

⁴ Klingstedt, *Mem. Soc. pro Fauna et Flora Fennica*, **12**, 194 (1937).

⁵ Darlington, *Proc. Roy. Soc.*, B, **121**, 281 (1936).

⁶ White, *Proc. Roy. Soc.*, B, **124**, 183 (1937).

⁷ Sax, *Amer. J. Bot.*, **24**, 218 (1937).

Double Structure of Chromosomes

IN response to our demonstration¹ that the metaphase chromosomes of *Trillium* are composed of four strands twisted about each other in pairs, while the anaphase chromosomes contain two intertwined threads, Dr. Darlington² states that the appearance of two threads is an artefact induced by a fixative containing acetic acid, and due to "bubbles" arising in the chromatid. In confirmation of this, he publishes a photomicrograph of a cell in telophase which bears little resemblance to our figures.

The preparations photographed in our letter were fixed in strong Flemming, which contains acetic, but other preparations made at the same time and fixed in Benda without acetic, following treatment with vapour of ammonia, hydrochloric or nitric acid, gave the same result. This disposes of Dr. Darlington's argument that the double threads are due to the treatment, even if it were not untenable on other grounds. His "bubble" theory is a revival, under another name, of the conception which was current in 1911, and earlier, that anaphase and telophase chromosomes developed alveoli or vacuoles in passing into the resting condition. Also, according to definition, bubbles are composed of gas or vapour in a liquid medium, so that the use of the word is incorrect.

Dr. Darlington's question regarding the possibility of three threads in metaphase chromosomes is misleading, because a photograph in one plane of two intertwined threads twisted around two other intertwined threads will give, in places, a superficial appearance of alveoli side by side. But a photograph at this magnification cannot be taken in three dimensions.

Dr. Darlington has introduced the subject of chromomeres which has been dealt with in a paper now in course of publication. Suffice it to say that all recent critical observations on plant chromosomes show a continuous chromonema and not a discontinuous row of chromomeres.

Finally, it may be pointed out that the photomicrographs published in our previous letter¹, showing the doubleness of the chromosomes in *Trillium sessile*, were only the final proof concluding a long line of increasingly cogent evidence. That evidence is contained in innumerable papers from many laboratories, some of them so early as 1926, including a series of papers from this laboratory beginning in 1931. Dr. Darlington and his supporters

face this mass of evidence with the assertion that the chromosomes must be single in anaphase and telophase because some of the X-ray experiments can be interpreted in this sense. White's work³ on the X-irradiation of the first meiotic division in three species of insects casts doubt on this interpretation.

R. R. GATES.

S. V. MENSINKAI.

King's College,
London. March 9.

¹ NATURE, **140**, 1013 (1937).

² NATURE, **141**, 371 (1938).

³ White, M. J. D., *Proc. Roy. Soc.*, B, **124**, 183-196 (1937).

Effect on Organisms of Summer Drought in Caves

AMONG the most interesting of cavicolous invertebrates from Herzegovina is the Serpulid, *Marifugia cavatica* Abs. and Hrabě¹. This remarkable worm, although belonging to a typical marine group, forms its calcareous tubes in great quantities over the walls and ceiling of the inland limestone cave known as Crnulja, in Popovopolje. The worm itself is known from this and a few neighbouring caves only; deserted tubes or their debris are more widely distributed, and may point to the existence of the worm in uninvestigated recesses of caves as far north as Istria. While visiting Popovopolje in August 1937 I found debris of the tubes in the much-explored Vjetrenica pećina, where Remy² has stated that it does not occur. I brought back some of the living worms from Crnulja to England, and am indebted to Mr. C. C. A. Monro for confirmation of the species.

During the winter the worms are immersed in fresh water; for the rest of the year they live retracted within their tubes, covered by only a thin film of water of condensation. The conditions then are so dry that Remy records the desiccation of a Plumatellid and its formation of statoblasts. In this connexion, I would record finding among the tubes of my *Marifugia* quantities of sponge gemmules, which have been identified by Dr. M. Burton as those of *Ephydatia mülleri* Lieberkühn. Above ground the gemmules of related Spongillidæ are stimulated to germinate by increase in temperature and give rise to young sponges in the spring. But, in the cave, conditions are reversed; the gemmules occur in summer and must give sponges in winter, the only time when the cave is flooded and sufficient water is available for active sponge life.

On returning to England, I made germination experiments with the cave gemmules, using gemmules of epigeal *Spongilla lacustris* as a control. Of the latter, 50 per cent germinated in 10 days, and gave good sponges, with oscula and flagellated chambers. Of the cave species, however, only 2 per cent germinated in a period of 22 days; and the development here was quite abortive, neither oscula nor flagellated chambers appearing, although the germinating sponge material lived long enough and was extensive enough to have thus differentiated. It would seem, then, that in respect of gemmule germination, this cavicolous strain of *E. mülleri* reacts quite differently from the epigeal *E. fluviatilis* L., which, according to Brien³, behaves similarly to the control, *Spongilla lacustris*.

R. S. HAWES.

Zoology Department,
King's College,
University of London.
Feb. 21.

¹ Absolon, K., and Hrabě, S., *Zool. Anz.*, **88**, 249 (1930).

² Remy, P., *Bull. Mus. Hist. Nat., Paris*, **9**, No. 1, 66 (1937).

³ Brien, P., *Arch. Zool. exp. gen.*, **74**, 461 (1932).