

not a part of P_1 was left attached. The smallest pieces of apical tissue which regenerated had only twelve cells in the superficial layer, and were equivalent to not more than one-twentieth of the area of the apical meristem. The vascular system of such regenerated shoots was invariably solenostelic.

On two occasions out of 123 very small apical panels failed to regenerate as shoots, but underwent a limited amount of growth, developing as centric organs similar to those previously obtained by isolating a presumptive leaf position from the apical meristem⁷.

The experimental evidence presented here indicates that very small groups of superficial cells of the apical meristem are able to regenerate a shoot, providing they are freed from the competition of other regions of the apical meristem for the supply of available nutrients from the subapical region, and that such competition between different regions of the apical meristem is one of the regulatory mechanisms by which the form of the apical meristem is preserved.

I. M. SUSSEX

Department of Cryptogamic Botany,
University, Manchester.
Sept. 10.

¹ Wetmore, R. H., and Wardlaw, C. W., *Ann. Rev. Plant Physiol.*, **2**, 269 (1951).

² Wardlaw, C. W., *Phil. Trans. Roy. Soc., B*, **233**, 415 (1949).

³ Linsbauer, K., *Denkschr. Akad. Wiss. Wien*, **93**, 107 (1917).

⁴ Pilkington, M., *New Phytol.*, **28**, 37 (1929).

⁵ Wardlaw, C. W., *Phil. Trans. Roy. Soc., B*, **234**, 583 (1950).

⁶ Ball, E., *Amer. J. Bot.*, **37**, 660 (1950).

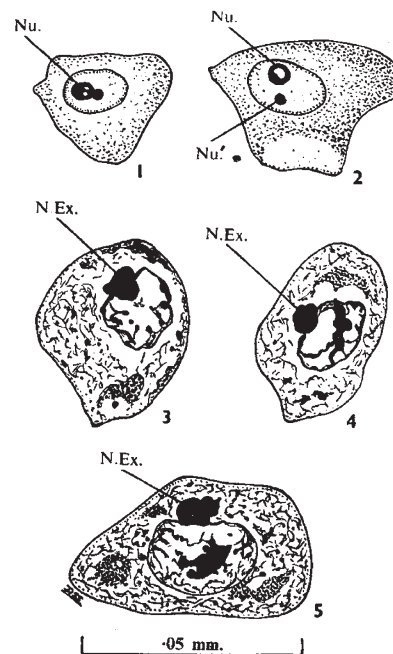
⁷ Sussex, I. M., *Nature*, **167**, 651 (1951).

Extrusion of Nucleolar Material in the Female Germ-Cells of *Lumbricus terrestris* L.

So far as I am aware, the extrusion of nucleolar material into the cytoplasm has not been recorded for the female germ-cells of *Lumbricus* or any other earthworm. In this connexion, Harvey¹ remarked that in the nuclei of the "nearly ripe oocytes there may occur little droplets of material, similar in reactions to the plasmosome. They may be lying on the surface of this body, or may be entirely separate. Occasionally they are seen on the nuclear membrane, but never outside it. This may point to extrusion of nucleolar fragments, but only on a very small scale and never into the cytoplasm". Gatenby and Nath² observed that: "Neither Harvey nor the present writers have found any satisfactory evidence of nucleolar emission in *Lumbricus*".

My preparations of the ovaries of *Lumbricus*, fixed in Bouin's fluid and stained with Ehrlich's hæmatoxylin or iron-hæmatoxylin, show convincingly that extrusion of nucleolar material takes place. The nucleolus is stained a purplish colour with Ehrlich's hæmatoxylin. Often the nucleus contains two nucleoli, and in such cases the larger one contains one or more lightly stained droplets, while the smaller body appears to be homogeneous (Figs. 1 and 2); the latter seems to originate from the large nucleolar body (Fig. 1) and is ultimately extruded into the cytoplasm. After iron-hæmatoxylin, the nucleolus and nucleolar extrusion are uniformly black throughout.

The nucleolar material which is extruded into the cytoplasm takes the form of a large, spherical nucleolus-like body which seems to press against the



Oocytes of *Lumbricus terrestris* from sections of ovary fixed in Bouin and stained with Ehrlich's hæmatoxylin (Figs. 1-2) or iron-hæmatoxylin (Figs. 3-5).

Nu., nucleolus; Nu', smaller nucleolus; N.Ex., nucleolar extrusion

nuclear membrane and gradually passes into the cytoplasm, where finally it breaks up into smaller particles. The process appears to take place repeatedly, as I have observed it in oocytes of different sizes. Figs. 3 and 4 show two stages in the emission of nucleolar material; in Fig. 3, a nucleolar extrusion has passed half-way through the nuclear membrane, while in Fig. 4, an extrusion in another oocyte lies almost wholly in the cytoplasm. In Fig. 5, a similar body is shown in the cytoplasm, and already shows signs of breaking up into smaller pieces.

The presence of nucleolar extrusions in the female germ-cells of many animals has previously been described. Among annelids, the classical example of *Saccocirrus*, recorded by Gatenby³, is well known. Unlike *Saccocirrus*, however, the extrusions of *Lumbricus* are large, spherical bodies resembling a nucleolus; in fact, in this animal the nucleolar extrusions more closely resemble those of *Libellula depressa* described by Hogben⁴. The presence of nucleolar extrusions indicates that the female germ-cells of *Lumbricus*, and probably those of other earthworms, are much more complex structures than supposed by previous workers such as Nath and his collaborators^{2,5,6}.

I wish to express my thanks to Prof. R. A. R. Gresson, for guidance and valuable help.

D. S. SRIVASTAVA

Department of Zoology,
Queen's University,
Belfast.
May 2.

¹ Harvey, L. A., *Quart. J. Micr. Sci.*, **69**, 291 (1925).

² Gatenby, J. B., and Nath, V., *Quart. J. Micr. Sci.*, **70**, 371 (1926).

³ Gatenby, J. B., *Quart. J. Micr. Sci.*, **66**, 1 (1922).

⁴ Hogben, L. T., *Proc. Roy. Soc., B*, **92**, 60 (1920).

⁵ Nath, V., *Quart. J. Micr. Sci.*, **73**, 477 (1930).

⁶ Nath, V., and Bhatia, C. L., *Proc. Nat. Inst. Sci., India*, **10**, 231 (1944).