The production, in certain varieties of apple, of diploid pollen by heat-shock treatment of the pollen mother cells has enabled Dr. D. Lewis to raise triploids from diploid varieties, including varieties Northern Spy and Beauty of Bath. The induced triploids have the marked advantage, in a highly heterozygous plant, of possessing a complete diploid genotype from one parent, while segregation in the female parent provides for limited variation. Triploids from Northern Spy should provide a vigorous rootstock immune to woolly aphis.

Dr. A. J. Bateman, working on the isolation requirements of crops grown for seed, has demonstrated that, in all crops investigated, contamination between adjacent blocks of varieties falls to 1 per cent or less at a separation of 150 ft., even in conditions under which it is most favoured, in both wind- and insect-pollinated crops. He suggests that growers' reports of serious contaminations over distances of furlongs or even miles are better explained by contamination in a previous generation masked by dominance or genic interaction.

Dr. C. D. Darlington, the director, refers to work on the effects of X-rays on the pollen mother nuclei of *Tradescantia bracteata* during meiosis. Low dosage (45r.) led to end-to-end association of pairs of bivalents at metaphase, due not to breakage and reunions between non-homologous chromosomes, but to crossing-over between the segments of different chromosomes usually regarded as non-homologous. Breakage and reunion do occur, but exclusively within single chromosomes, to give centric or acentric rings. This suggests that the chromosomes before meiosis appear to behave as isolated units.

Further investigations upon which reports are submitted include trials of Merton varieties of cherries and haricot beans; trials of bush and dwarf tomatoes; incompatibility in polyploids with reference to *Œnothera organensis*; mutation and the production of self-fertile fruits in sweet cherries and *Œnothera*; the action of camphor, lactic acid, D.D.T., 'Gammexane' and sulphonamides on cell division; primary and secondary pairing in polyploids; artificial drying of seeds in relation to viability and germination; interspecific sterility and incompatibility in *Rubus*; the analysis of polygenic inheritance; and breeding systems and genetic isolation with reference to certain *Antirrhinum* species.

## STRUCTURE AND MECHANICS OF THE PROTOZOAN FLAGELLUM

HARLEY P. BROWN has made an important contribution to our understanding of this subject (*Ohio J. Sci.*, **45**, No. 6, 247; 1945). His paper begins with an extensive and highly critical review of the great amount of work already done on the morphology of the flagellum, and more than a hundred authors are mentioned.

An account is then given of the author's own investigations using the electron microscope. The section gives useful advice as to the preparation of the specimens for this new technique, and the results are shown in twelve beautiful plates, each with a micron scale. It is concluded that each flagellum is of approximately uniform diameter throughout and consists of a denser axial core surrounded by a less dense sheath, though in *Euglena* and *Astasia* the core appears to consist of two closely approximated fibres of equal size. The sheath seems to contain, or to consist of, a spirally coiled fibre surrounding the core. The flagella of *Euglena* and *Astasia* have also, along one side, what appears to be a single row of delicate filaments extending out from the sheath; their length is about five or six times the flagellar diameter, namely, 1·5–2·0 μ. The long flagellum of *Ochromonas* bears similar filaments probably on all sides, but that of *Chilomonas* is devoid of filaments.

The mechanics of the flagellum is then considered and investigated by ingenious experiments. The motion of the flagellum was rendered visible by mounting in a viscous solution of methyl cellulose. In every case, the wave impulse travelled from the base towards the tip, in a spiral course, producing rotation of the tip. All these observations directly support conclusions arrived at by A. G. Lowndes[1]. A model flagellate was also constructed, and the author swam completely immersed, gyrating one or both arms in a relatively narrow cone. These experiments again confirm Lowndes' hypothesis, and show further that rotation of the gyrating object is not necessary for the production of a forward component, since mere gyration of an object (arm or flagellum) can produce an effective locomotor force.

It is thus shown that Lowndes was correct in stating that: (*a*) the flagellum beats in spiral undulations; (*b*) the waves of contraction progress from the base towards the tip of the flagellum, and often increase in amplitude as they progress; (*c*) the flagellum serves to push, rather than to pull, the organism through the water, although it arises from the anterior end of the body; (*d*) that rotation and gyration of the body alone may account for the locomotion of many flagellates.

This work should finally dispose of the view that the flagellum acts as a tractellum and draws the body forward. It constitutes one more reaction to the scientific stimulus produced by Gray's book "Ciliary Movement". W. R. G. ATKINS

[1] Lowndes, A. G., *Nature*, **138**, 210 (1936). *Proc. Zool. Soc. Lond.*, **114**, 325 (1944).

## EXPERIMENTAL MORPHOLOGY: SHOOT APICES IN STERILE CULTURE

IN a paper of very considerable interest, Dr. E. Ball (*Amer. J. Bot.*, **33**, No. 5, 301; 1946) has described the development in sterile culture of shoot apices and subjacent regions of *Tropæolum majus* and *Lupinus albus*. The work, which is directed towards the solution of problems of development and differentiation at the shoot apex, depends on a precise technique of dissection, which is described, on observations of the development of the experimental materials in synthetic culture media, and on a detailed histological examination of the growths eventually produced.

Dr. Ball has been able to show that minute apical segments, comprising the terminal meristem, will grow in culture media and eventually develop into entire plants. The shoot apex of *Tropæolum*, which has a lower respiratory rate than its subjacent tissues, will only grow into a complete plant when submerged in the agar medium. Comparable apices of *Lupinus*, which have the highest respiratory rate of the shoot, will only grow into complete plants if placed on the surface of the agar. Hence primary