Among miscellaneous grants, the report refers to one of £9,000 to the Imperial Agricultural Bureau to accommodate the Empire potato collection, and one of £1,500 to the Medical Research Society to permit purchase of the assets of the journal *Clinical Science* and to prevent a rise in price of the journal during the next five years.

UNITED STATES NATIONAL MUSEUM

REPORTS FOR 1944 AND 1945

THE extensive work carried out by the United States National Museum in the interest of the war effort is an outstanding feature of the report for 1944 (Washington, D.C.: Gov. Printing Office, 35 cents). Under the heading, "The Museum in Wartime", the chief of the departmental services rendered are described. Some of these include the following: Dr. Kellogg's preparation (for the National Research Council) of text and illustrative matter relative to monkeys known to be susceptible to infection by malarial parasites; the supply to various organisations of the Services of information regarding the identification and distribution of mammals involved in the transmission of diseases; the provision of information relating to the habits of certain mosquitoes, mites and ectoparasites sent in for identification by various Army and Navy units; the supply (to Army and Navy medical and other training centres throughout the country) of several hundreds of specially mounted specimens of insects and Acarina species involved in human health problems; suggestions for tropical and Arctic clothing; information regarding water supply and population statistics of the Caribbean Islands, house types in Burma, and the degree of western influence in certain Pacific islands and in the Philippines; the provision of information (based on collections in the Department of Anthropology) regarding the resources of certain strategic areas, and so on.

During 1944, Dr. G. A. Cooper concluded his field studies on the stratified rocks of Sonora, and it is reported that the results of his work (to be published shortly) will assist in the location of new mineral areas. Dr. Cooper also finished field-work on a project concerned with the Devonian sub-surface geology of Illinois, and information has been obtained which will be useful for the oil development of that and neighbouring States. Other work connected with the Department of Geology included the continued supervision by W. F. Foshag of surveys for strategic minerals in Mexico.

Under the section of the report dealing specifically with the activities of the Department of Geology, reference is made to the present-day scientific value of plaster casts of type fossils—"in view of the destruction taking place in foreign museums". In this connexion, mention is made of a cast of the English Carboniferous crinoid, *Poteriocrinites crassus* Miller, received as a gift from the British Museum (Natural History). The holotype and only specimen of this was housed in the Bristol Museum, which was destroyed by enemy action during the War.

The report ends with a 28-page list of accessions, and a list of the Museum's publications issued during the fiscal year 1943–44.

The report for 1945 of the United States National Museum (25 cents) comments on the necessity for additional housing space if the progressive work of the Museum is not to be hindered. In this connexion, allusion is made to the wealth and utility of the Museum's scientific materials in the future development of American natural resources, agriculture and industry. Congress has already authorized the addition of wings to either end of the Natural History Building as soon as public building projects are possible, and now plans for separate buildings for engineering and industries and for American history have been estimated for authorization. The proposed engineering and industries building would take the place of the present arts and industries building, which is, to quote the report, "an antiquated brick structure . . . no longer suitable for modern installations in museum display".

JOHN INNES HORTICULTURAL INSTITUTION

ANNUAL REPORT

THOSE who are acquainted with the limitations of space under which the John Innes Horticultural Institution has laboured in past years will welcome the forthcoming transfer to its new site at Bayfordbury Park, Hertfordshire, already described in *Nature* (156, 586; 1945).

The thirty-sixth annual report of the Institution, for 1945, covers a very wide field of investigation.

The replacement of existing virus-infected, low-yielding clonal stocks of raspberries is a pressing necessity. M. B. Crane's work on high-yielding F_1 families of seedling raspberries promises to provide a rapid method of producing virus-free seedling stock of sufficient uniformity. He records that the yield of the best hybrid family is 60 per cent higher than that of a selected stock of Norfolk Giant. Further extensive trials of F_1 families planted in 1945 have been bred for greater uniformity, especially in respect to firmness and colour of fruit.

Several investigations on the tomato are in progress; A. G. Brown, working on hybrid vigour, reports in all cases considerably higher yields from F_1 families than from either parent. A breeding investigation aimed at combining high yield with early maturity is in progress. Dr. D. Lewis is endeavouring to obtain a degree of frost hardiness in hybrids derived from crosses between certain wild species of tomato, collected from high altitudes in Peru, and cultivated varieties. Messrs. W. J. C. Lawrence and J. Newall have shown, notably in tomatoes, that earliness and total yield depend to a remarkable degree on seedling treatment designed to avoid any check to rapid development. Factors of great importance are the minimizing of root disturbance by pricking out small seedlings directly into pots, and the employment of pots sufficiently large to allow unrestricted root development. Further experiments show the importance of adjusting the fertilizer balance and concentration in the seedling compost to an optimum level, and the feeding of root-bound plants with a balanced fertilizer prior to transplanting. In winter, however, the influence of reduced light intensity in glasshouses is shown to be of over-riding importance, outweighing all other factors.

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, $1 \cdot 5$–$2 \cdot 0\,\mu$. 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