inadequate for its needs. It would be out of place for me to enlarge on the advantages to be expected from securing the concentration of the headquarters of the University and its two incorporated colleges on a single site, in a quiet residential quarter close to our greatest National Library and Museum, and capable of expansion in the future as the need may arise. The merits of this site, as of other alternative sites which have from time to time been suggested, have, I know, been the subject of much discussion by the friends of university education in London, and I have no doubt that the University is fully apprised of the considerations which need to be weighed. I have no desire to persuade the University against its will. No one recognises more fully than I do the right of universities to control their own destinies and shape their own policies. The responsibility for accepting or declining the Government's offer must rest wholly with the University, which alone is in a position to estimate how far the proposal I communicate to you is likely to advance what it conceives to be its true interests. The view of the Government is, I think, sufficiently indicated by their willingness to provide for the University a site of great value in the heart of London, at a time when there is no temptation to incur expenditure upon any but objects of first-rate urgency and importance.

"It had at one time been my hope that the Government would be able to offer not only the site of which I have spoken, but also the buildings for the new University headquarters: the Government have, however, reluctantly come to the conclusion that, while they are prepared to make such provision as will secure the University from loss in respect of maintenance charges on the new University headquarters, the state of the national finances did not justify their undertaking to provide the cost of the buildings themselves from public funds. They feel that in a matter in which the honour and dignity of the City of London are so nearly concerned, the University can look with confidence to the generosity and public spirit which have always marked the citizens of London: it can do this with the greater assurance that recent years have shown an increasing readiness upon the part of the great business community to respond to appeals for University purposes.

"I am aware that a matter of such importance to the University needs to be fully discussed, and that I cannot fairly expect an immediate answer to the Government's offer. At the same time the University will understand that the Government are naturally anxious to know as soon as possible whether their offer will be accepted or not, since, if it should be declined, they propose to make early use of the site for other purposes. I have, therefore, to ask that the University's answer may not be unduly delayed."

The matter was referred to a special committee for consideration and report as speedily as possible.

Genetic Studies of Drosophila.[1]

NO single animal has provided such a rich field for discovery in genetics as the little fruit-fly Drosophila (usually known as *D. ampelophila*, but now called *D. melanogaster*), and in this large and handsomely illustrated volume Prof. Morgan and his collaborators bring together the results of some of their recent work upon it. Of the four parts into which the book is divided, the most interesting is the first, dealing with the gynandromorphic specimens that have appeared in Prof. Morgan's and Dr. Bridges's experiments, and including a most valuable summary and discussion of gynandromorphism in other animals. In Drosophila it appears that about one individual in every 2200 is gynandromorphic, but these gynandromorphs are most varied in their combination of male and female characters. A considerable proportion of those described are bilateral, with male secondary sex-characters on one side and female on the other; a smaller number are "fore and aft"; while the majority are irregular mosaics, most often with a preponderance of female characters. It is a remarkable fact, however, that in Drosophila, contrary to what is usual in animals of other groups, the two gonads are always of the same sex—doubtless, as the authors point out, in consequence of the very early separation of the primitive germ-cells in the Diptera. As a result of this, it may happen that a fly is externally almost entirely of one sex while containing germ-cells of the other sex, so that Nature here confirms the conclusion reached by Meisenheimer and by Kopeč from transplantation experiments, that the sex of the gonad in insects has no influence on the secondary sexual characters. Flies externally chiefly male, but having ovaries instead of testes, court normal females, but attract males.

The authors believe that in all but very exceptional cases gynandromorphs of Drosophila are derived from fertilised eggs which would normally produce females, *i.e.* from eggs containing two X-chromosomes, and that the male portions arise from cells in which one X-chromosome has been lost through an abnormal mitosis in one of the early segmentation divisions. The evidence for this conclusion is that in almost every instance the sex-linked factors borne (according to the chromosome hypothesis) by the two X-chromosomes introduced from the parents are distributed as might be expected between the male and female portions of the fly. For example, a wild-type female (heterozygous for eosin eye and miniature wing) was crossed with an eosin-miniature male. A gynandromorph among the offspring was female on the left side, with red eyes and long wing, while the right side was male with eosin eye and miniature wing. The explanation offered is that elimination of the maternal X-chromosome on the right side allowed the recessive eosin-miniature characters borne by the remaining X-chromosome to appear. Morgan's earlier hypothesis of the production of gynandromorphs by the entrance of two spermatozoa into the egg, and Boveri's of the division of the egg-nucleus before conjugation with the sperm-nucleus, are excluded by the fact that the non-sex-linked characters borne by the two parents are not divided between the parts showing different sexes. In respect of these characters, all parts of the gynandromorph, whether male or female, bear the dominant characters, whether they are introduced by the male or female parent. The analysis of these gynandromorphs thus gives important confirmation to the theory of chromosomes as bearers of hereditary characters. It is remarkable, in this connection, that although elimination of the paternal and maternal X-chromosome is equally common, evidence for the elimination of other chromosomes, which would give mosaics in characters unconnected with sex, is very rarely obtained.

Analysis of the records of gynandromorphs in other groups of animals shows that most are susceptible of the same explanation. In a few cases some other hypothesis, such as that of a binucleate egg, must be invoked. It should be noted that in part i. there

[1] Contributions to the Genetics of *Drosophila melanogaster*. I. "The Origin of Gynandromorphs." By T. H. Morgan and C. B. Bridges. II. "The Second Chromosome Group of Mutant Characters." By C. B. Bridges and T. H. Morgan. III. "Inherited Linkage Variations in the Second Chromosome." By A. H. Sturtevant. IV. "A Demonstration of Genes Modifying the Character 'Notch.'" By T. H. Morgan. Pp. v+388+12 plates. Publication No. 278. (Washington: Carnegie Institution of Washington, 1919.)

are several slips and misprints; on plate ii., Figs. 4 and 5 are transposed, according to the description; on p. 28 the word "visible" appears to be a misprint for "recessive"; and on p. 86, l. 26, "female" is printed for "male," etc. But apart from these slips and the rather inconvenient arrangement of the subject-matter, the work is the most valuable on the subject of gynandromorphism with which we are acquainted.

Space does not allow of more than a brief reference to the other three parts. Part ii. discusses in detail all the mutant characters that have occurred in "the second chromosome," *i.e.* those characters belonging to the second linked group which are not sex-limited (sex-linked) in inheritance. Full data of crossing-over ratios are given, and on the basis of these a map of the chromosome is constructed, like those previously published for the X-chromosome. Part iii. deals with inherited linkage variations in the same group, and it is concluded that two factors, the position of which in the series is determinable by their linkage relations, reduce the amount of crossing-over between certain factors without altering their sequence in the series. Part iv. describes the isolation by selection of a factor which affects the extent of development of the character "notch" in the wing, and proves that change resulting from selection is due, not to an alteration in the factor for "notch," but to the presence of a distinct modifying factor. It is also shown that Castle's hypothesis of contamination by heterozygosis is untenable.

Finally, it is impossible to read the facts presented in this volume without being impressed by the great strength of the evidence for Morgan's theory that Mendelian factors are borne by chromosomes and arranged in definite sequence within them. Difficulties remain, but a theory which enables predictions to be made and verified cannot lightly be disregarded.

L. DONCASTER.

The Conservation of Fuel.

IN view of the importance of national economy in our fuel reserves, it is not surprising to find that Sir Dugald Clerk selected the subject of the conservation of fuel in the United Kingdom for the James Forrest lecture which he delivered at the Institution of Civil Engineers on April 20. The coal raised in 1913 was about 287·4 million tons, of which 189 million tons were retained and consumed here. The total coal reserves at 2 per cent. per annum increase will be exhausted in about 250 years, but fuel will be so expensive long before that time has elapsed that we shall be hard pressed to maintain the existing population. A return to the agricultural civilisation of 1750 would require the reduction of our population to one-third. It is of the utmost importance to study the engineering problems arising.

A great part of the lecture was taken up in criticising the figures given by the Coal Conservation Committee. It will be remembered that this Committee advocated the establishment of large turbo-electric stations at about sixteen centres, and the covering of the country with a network of mains capable of supplying our whole power needs by electric motors. By this scheme the Committee expected to save 55 million tons of coal on power alone. Many competent electricians and capable motive-power engineers have the gravest doubts as to the accuracy of the data presented, and as to the outcome of the ambitious scheme advocated. The Committee adopted the figure of 5 lb. of coal per horse-power-hour as the present consumption; Sir Dugald gave estimations arrived at by two different methods: one of 3·9 lb. per b.h.p.-hour and another of 4·05 lb. per b.h.p.-hour. The first value is based on a census of production data corrected by allowing for steam production other than for motive power, and for an error in total h.p.-hours as determined by the Committee. The second value of 4·05 lb. is estimated by considering the average of many typical steam engines. Taking the whole of the facts into consideration, and assuming electricity in the future to be used for the generation of power and light only, then a reduction to 1·56 lb. of coal per b.h.p.-hour would give a possible saving of not more than 37½ million tons of coal per annum. The saving of 55 million tons expected by the Committee is, in Sir Dugald Clerk's opinion, based on fallacious reasoning.

The Committee in its report clearly intends also to generate heat, and expects to do so with economy superior to the existing systems of coal and gas combustion. Sir Dugald went into the question of the comparison of gas with electricity for domestic heating, and arrived at the figure of 43·6 per cent. of the heat used at the gasworks as the proportion which the consumer receives at his premises; taking the efficiency of the gas at 42 per cent., the final efficiency, referred to the heat consumption at the gasworks, is $43{\cdot}6 \times 0{\cdot}42 = 18{\cdot}3$ per cent. In electric heating the consumer receives 11·7 per cent. of the heat consumed in the thermodynamic transformation at the super-station, and using this with an efficiency of 59 per cent., the consumer obtains in his apparatus $11{\cdot}7 \times 0{\cdot}59 = 6{\cdot}9$ per cent. of the heat units consumed at the generating station. Assuming the gasworks to be abolished, and electric generating stations to be expanded so as to supply current for heat supply at the same generating efficiency as for power, and taking all facts into consideration, Sir Dugald estimates that the whole assumed saving on power will be lost, and that 68·6 million tons of coal per annum will be consumed instead of 67·5; he therefore considers that the super-stations will not justify their existence, that the Government scheme is wrong, and that the sweeping conclusions arrived at by the Coal Conservation Committee are unjustifiable.

Sir Dugald gives some methods of saving fuel which are immediately applicable. Great changes are now in operation throughout the gas industry due to the adoption of the thermal unit standard for sale. In a few years the majority of gasworks will deliver to the consumer in the form of gas 75 per cent. of the whole heat of the coal, and the improvements in gas apparatus, etc., are so great that the efficiency of use of the gas will rise from 42 to 55 per cent. He estimates that a saving of 4·8 million tons of coal on the present consumption will result from these changes. On the assumption of the complete displacement of coal in households by gas, we should use only 17·5 million tons instead of 35 millions.

Mr. D. Brownlie's figures for coal consumed in boiler furnaces were quoted. If boiler attendants be better trained, and masters take some pride in obtaining best efficiencies, a saving of 4 million tons per annum would result. Collieries consume about 17 million tons per annum in boiler furnaces at an average efficiency of 55·5 per cent. If this be raised to 75 per cent., the saving on this item would be 4·4 million tons per annum.

The notion of the great gain to be expected from very large steam turbines is held to be quite erroneous. Even with the most modern plant an increase in power per turbine from 10,000 to 100,000 kilowatts only reduces the steam consumption from 9 to 8·5 lb. per kilowatt-hour. A recent examination by Sir