Recent Genetics.

THAT genetical conceptions continue to permeate modern botany and zoology in many directions is shown by recent work. Genetics and cytology can no longer be regarded as special subjects of which the naturalist can afford to be ignorant. They are making their influence increasingly felt in every phase, not only of experimental biology, but also of systematic and descriptive work. This will be true in a larger sense as further genetic analysis throws more light on the nature of the inherited varietal and specific differences.

One of the plants which has been most prolific in genetic results in the hands of Bateson and his co-labourers is *Primula sinensis*. Experiments with it began soon after the discovery of Mendel's results. After being carried on for many years by the late R. P. Gregory, they have been continued at the Merton Laboratory, and a paper (*Journ. of Genetics*, vol. 13; No. 2), to which the names of Gregory, Miss D. de Winton, and Bateson are attached, recounts many new results. Some 18 pairs of characters have been investigated, relating to forms of the leaf and corolla, colours of petals and stigma, the extent of the "eye" of the flower, the heterostyle condition, and single and double flowers. Interesting interactions between factors have been observed. Thus not only is crimping of the leaf margin associated with fringing of the petals, but the factors governing the extent of the yellow eye and the character of the leaf margin interact with each other.

Various new forms have appeared or have been acquired in connexion with the experiments. Thus a variety called Lee's, which appeared spontaneously in a private garden, differs in crimping, colour, shape of flower, and eye-structure from any known variety, and all these changes apparently result from the loss (or change) of a single factor. The known leaf forms include ivy, tongue, palm, oak, fern, and crimped, the last four representing three pairs of unlinked factors recessive to palm-leaf. In the F_2 of a cross a new "Harlequin" type appeared, whether as a single individual or more is not stated. It has some petals paler and smaller than the others, and behaves as a simple recessive.

Two linkage groups have been found, one containing four factors, the other two, and their cross-over relations have been determined. It is found that the degree of linkage for the first group differs greatly in the male and female sides of the same plants. Examples are already known in which the general behaviour of the chromosomes is different in the pollen and embryo sac formation, and it appears that this may also extend to the behaviour of individual chromosome pairs with relation to each other.

In a discussion of the history of *P. sinensis* and other species (*P. obconica* and *P. malacoides*) which have given rise to many new forms in cultivation, it is concluded that the new types have arisen through "spontaneous variation," and not as a result of crossing. Indeed, none of these species has been artificially crossed successfully.

To turn for a moment to animals, the stream of Drosophila results is unabated. Recent publications on the genetics of this fly include a good-sized volume on the third-chromosome group of characters.[1] Similar studies of the first or sex-linked and the second series of characters have already appeared. The number of mutations now recognised in *Drosophila melanogaster* is about 400. In the present work the history of the discovery and the genetic behaviour of each mutant in the third group is given, the whole making a formidable array of refined genetical data. Chromosome maps have been constructed from the cross-over percentages and used successfully as a basis for prediction, and crossing-over frequencies are found to vary consistently with age and temperature. It has also been shown that mutant conditions occur which modify or may nearly suppress or even increase the crossing-over in one or all the chromosomes, or in one region of a chromosome. By selecting out such genes the offspring may show a return to the standard amount of crossing-over. A number of genetic peculiarities are associated with the factors which appear to be located about the middle region of chromosomes II. and III. There are reasons for suggesting here that these long chromosomes are really two chromosomes united end-to-end. This hypothesis has cytological evidence in its favour, and would also help to explain the genetic facts.

In a study of *Drosophila virilis*,[2] which has 6 pairs of chromosomes instead of 4, the stock was derived almost entirely from a single pair, and has been kept in the laboratory for eight years. Already a number of mutations have appeared, and they fall into 6 linkage groups, numbering respectively 18 (sex-linked), 4, 6, 3, 5, and 2 characters. As in *D. melanogaster*, crossing-over occurs only in the female, and the Y-chromosome appears to be functionless. At least four of the mutations, namely, yellow (body colour), forked (bristles), crossveinless, and confluent (veins), are parallel to those of *D. melanogaster* and show similar linkage relations. In another species, *D. simulans*, five such parallel mutations have been studied. In *D. Willistoni*, with 3 pairs of chromosomes, there are only 3 linkage groups. All these facts strengthen greatly the view that an exact parallel can be traced between chromatin morphology and hereditary behaviour.

Mavor has recently found (*Science*, April 27, p. 503) that when Drosophila females are treated with X-rays for even 3 or 4 minutes, non-disjunction of the X-chromosomes may be produced in either of the maturation divisions, leading to the production of XXY females more frequently than they normally occur. He also finds (Proc. Soc. Expl. Biol. and Med., vol. 20, p. 335) that a brief treatment lessens the frequency of crossing-over between the X-chromosomes for six days afterwards, while (Mavor and Svenson, *Science*, August 17, p. 124) it *increases* the frequency of crossing-over in the second chromosome. This indicates different effects on the individual chromosomes.

Bateson[3] was apparently the first to apply genetic conceptions to the distinctions between species. He showed how the differences between certain species of North American woodpeckers and warblers might be interpreted in terms of two or three pairs of unit factors, but pointed out difficulties in applying that interpretation. The writer applied similar conceptions to a number of plant species[4] in various families, and also to the North American screech-owls.[5] That such conceptions are becoming of increasing value to the systematist is shown by a recent paper of Chapman,[6] in which he applies the current conceptions of

[1] Bridges, C. B., and T. H. Morgan, 1923. The third-chromosome group of mutant characters in *Drosophila melanogaster*. Carnegie Publ. No. 327, pp. 251, figs. 37, pls. 3. Price 3 dollars.

[2] Metz, C. W., Mildred S. Moses, and Eleanor D. Mason, 1923. Genetic studies on *Drosophila virilis*, with considerations on the genetics of other species of Drosophila. Carnegie Publ. No. 328, pp. 94, figs. 17, pls. 5. Price 1.75 dollars.

[3] "Problems of Genetics," 1913.

[4] Gates, R. R., On pairs of species. *Bot. Gazette*, vol. 61, pp. 177-212, 1919.

[5] Gates, R. R., The mutation theory and the species concept. *Amer. Nat.*, vol. 51, pp. 577-595, 1917.

[6] Chapman, Frank M., 1923. Mutation among birds of the genus Buarremon. Bull. Amer. Mus. Nat. Hist., vol. 48, Art. 9, pp. 35, pls. 4.

mutation to a study of the distribution and relationships of certain finches of the genus Buarremon in Central and South America. He regards isolation as the most important external factor in the establishment of local varieties which arise through mutation, and believes that this interpretation affords a clue to the origin of many distinguishing marks in birds. The first example he cites is that of *B. brunneinuchus*, which extends from the mountains of Mexico down the Andes for a distance of some 5000 miles to Chile, in a zone which is often only a mile wide. Throughout this range no geographic races or sub-species have been recognised by ornithologists, but in the isolated Chimbo Valley in Ecuador a local species, *B. inornatus*, occurs. It differs in having no black pectoral band or collar and in having larger white areas below. A single specimen of *B. brunneinuchus* without the black collar is known. It was described in 1884 from Mexico, and is considered to be a mutant which only required isolation to produce a species like *B. inornatus*.

It is suggested in the same way that *B. poliophrys*, which occurs in Peru and has a black pectoral band, has been derived from *B. assimilis*, which is found in the Andes of Venezuela, Colombia, and Ecuador, and has no black band. In support of this view, one specimen of *B. assimilis* in a series from Quito was found to have a complete black band, and is believed to be a mutant. Similarly *B. borelli* of northern Argentina has no pectoral band and is believed to have been derived by a loss mutation from *B. fimbriatus* of Bolivia, which *has* a band. Dr. Chapman points out that various terms in descriptive ornithology, such as superciliary stripe, nuchal band, wing bars, malar streak, pectoral band, etc., are of service because of parallel mutations in the colour markings of many birds. The appearance of such mutations seems to be independent of environment; they are unaffected by selection but are perpetuated by isolation. No doubt the application of these and similar genetic conceptions will be a valuable aid to animal and plant systematists in the analysis of the specific and varietal differences with which they have to deal.

As illustrating the practical value of genetics we may cite a recent paper by Mr. G. L. Kottur on cotton breeding (Mem. Dept. Agric. India, Botany, vol. 12, No. 3), which gives an account of crosses between Indian varieties or *Gossypium neglectum* and *G. herbaceum*, and extends the earlier results of Fyson and others. *G. neglectum* types are easily grown (early), high yielding, high ginning, but with very short fibre. *G. herbaceum* is widely grown but requires a long growing period, and the types with good staple have a low ginning percentage. Four generations of crosses between these forms bring out many facts of inheritance, the most important of which is that ginning quality is inherited independently of length of fibre (long staple being dominant over short), and that it should therefore be possible to produce a type combining high ginning percentage with long white fibre. Such a type would add greatly to the value of the cotton crop in India. R. R. G.

Scientific Instruments and Research.

IN an article on "Industrial Research" (NATURE, December 1, p. 781) we referred briefly to the relation between Research Associations and the private research laboratories of individual concerns. It is encouraging to note that some firms, while participating in the work of the Research Association of their trade, have at the same time actively maintained their own research laboratories. Among these must be included the firm of Messrs. Adam Hilger Ltd., of 75A Camden Road, London, N.W.1. The work accomplished by the staff of the research department of this company during the past five years forms a very valuable record. The results of much of this work have been communicated in the usual way to various scientific societies; but the firm has gone further than this in having prepared and published several useful volumes by workers associated with the laboratory. These have been referred to in our columns at the time of their appearance, and include "Tables of Refractive Indices—Oils, Fats, and Waxes," compiled by R. Kanthack and edited by Dr. J. N. Goldsmith, "Report on the Quantum Theory of Spectra," by Dr. L. Silberstein, and "Wave-length Tables for Spectrum Analysis," by F. Twyman. A monograph on "Elements of Vector Algebra," by Dr. Silberstein, was also prepared for publication at the instance of and with the assistance of the firm.

In a lengthy list of papers published in scientific journals by the staff of the laboratory, we notice "An Interferometer for Testing Camera Lenses" (Trans. Opt. Soc., xxii. 4; *Phil. Mag.*, xlii., Nov. 1921), and "The Hilger Microscope Interferometer" (Trans. Opt. Soc., xxiv. 4; Journ. Opt. Soc. Amer., vii. 8), in which descriptions are given by Mr. Twyman of new instruments which are of great value in the examination of various types of lenses. As might be expected in work issued by a firm which specialises in the production of the best types of interferometric, refractometric and polarising apparatus, many of the research papers contain results of work rendered possible by such apparatus. The research staff has developed methods of measuring small variations in refractive indices of transparent substances, which has resulted in papers in the Transactions of the Optical Society and the Journal of the Society of Glass Technology dealing with variations in refractive index near the surface of glass melts, throughout meltings of optical glass, and in optical glass after chilling or tempering. Measurements made by Mr. Twyman and Mr. Dalladay of the stresses produced at the surface of glass by grinding with loose abrasive and by cutting with a diamond have increased our knowledge of the mechanism of glass grinding and polishing. Mention should also be made of the method described by Mr. Twyman and Mr. Perry (Proc. Phys. Soc., xxxiv., Part iv.) of determining the stress-optical coefficients, and of the paper by Mr. Simeon (Proc. R.S., A 104) in which are recorded shorter wave-lengths in the carbon arc spectrum than had hitherto been measured.

Of a different nature, but important from a practical point of view, is Mr. Twyman's paper (Trans. Soc. Glass Tech., vol. 6) describing a new method for controlling the annealing of glassware by means of a sample of the glass to be annealed.

Papers by Dr. Silberstein issued during the period under review include a note on the dispersion of diamond (*Phil. Mag.*, xxxvii., Apl. 1919), a supplementary chapter to his book on "Projective Vector Algebra" (*Phil. Mag.*, xxxviii., July 1919), and an investigation of the spectrum corresponding to an atomic system with a non-spherical nucleus (*Phil. Mag.*, xxxix., January 1920).

We have not detailed all the papers, but the above list will indicate the nature and value of the work done. The firm is to be congratulated on the enterprise and activity it has shown in this direction. Its efforts are all the more praiseworthy since they have been continued over a period in which the economic conditions in the scientific instrument industry have not been of the most favourable nature.