

fifteen years of age, who will afterwards be engaged in trade, represent roughly the type of school in which continuation classes can best be carried on.

It is useless to make continued education of primary-school pupils compulsory without the provision and adequate equipment of schools for practical instruction in close relationship with the occupations of the pupils. The schools should thus do something to relieve the monotony and extend the outlook of the young workman who, on account of the minute subdivision of manual labour, may spend his life upon one small detail of some product or process, and learn nothing beyond it. Industrial advance demands the production of intelligent and adaptable types of workmen; and practical continuation classes offer a means of training them which is impossible under modern conditions of manual work. Mr. J. C. Smail, organiser of trades schools for boys under the London County Council Education Committee, has recently studied in Germany the compulsory system of continued education for boys from fourteen to eighteen years of age; and we may appropriately give here a statement of the conclusions arrived at by him with regard to such schools, as they have a direct bearing upon the foregoing remarks, which were written before the report was published:—

(1) There has been, broadly speaking, a difference in ideals between Germany and Britain in the organisation of technical courses. Germany is aiming at benefiting the nation by training properly all the workers through definitely specialised courses. Britain has organised so that individuals may secure what they think best for their own advancement.

(2) The fundamental basis of any course of study for technical students must be their trade or employment. If this is recognised and acted on in the preliminary years from fourteen to eighteen there is little danger of work at more advanced stages, even if irregularly organised, being ineffective.

(3) Germany is aiming at making good citizens and has realised that a good citizen must be a good workman.

(4) Germany has come to believe that workshop training alone is insufficient to make a sound industrial nation; that it must be reinforced by adequate education specialised to trades.

(5) This specialised education must include specialised calculations, technology, drawing, and citizenship. Munich also believes in trade work in the compulsory schools, Berlin does not.

(6) Citizenship must be taught to enable the worker to recognise his individual position in the State, his position with respect to his employer and his fellow-workmen, his family and social duties, the relative position of his trade in his own country, and in the world's commerce and industry.

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#### CYTOLOGICAL ASPECTS OF HEREDITY.

THE current number of the *Quarterly Journal of Microscopical Science* (vol. lix., part 4) will be of exceptional interest to students of heredity from the cytological point of view. Dr. L. Doncaster contributes a very useful review of the present state of the evidence with regard to the material basis of hereditary transmission and sex-determination, under the title, "Chromosomes, Heredity and Sex." He concludes that the arguments in favour of the view that Mendelian characters are determined by chromosomes, though very strong indirectly, are lacking in direct evidence. The direct evidence of a relation between chromosomes and sex-determination is much stronger, and various cases are discussed. The phenomena of sex-limited inheritance, now known to occur in various

groups of the animal kingdom, taken in conjunction with this relation, afford strong support to the view that the chromosomes play a very important part in the transmission of Mendelian characters, although the part played by the cytoplasm must also be taken into account. With regard to sex-determination difficulties arise in connection with the fact that this has been shown in certain cases to be modifiable by environmental conditions, and it therefore seems probable that the sex chromosome is associated with a particular type of cell-metabolism, which in turn is responsible for sex-determination.

A very important contribution to the discussion is made by Dr. R. R. Gates and Miss Nesta Thomas in "A Cytological Study of *Oenothera mut. lata* and *O. mut. semilata* in Relation to Mutation." These authors find that in the "mutants" of the evening primrose known as "*lata*" and "*semilata*," fifteen chromosomes always occur instead of the normal fourteen. The peculiar characters of these mutants are thus shown to be associated with the presence of an extra chromosome, which they are believed to have acquired by the abnormal distribution of both chromosomes of one pair to the same daughter-nucleus in the reduction division, the actual occurrence of such abnormal distribution having previously been demonstrated by Dr. Gates. The authors maintain that mutations and Mendelian hybrids are not of the same nature but must be contrasted with one another, the former owing their origin to germinal changes (e.g. the presence of an extra chromosome), and the latter to recombinations of the parental characters. Dr. Gates adds a useful note on the meaning of the term "mutation," and the difference between "mutations" and "fluctuations."

#### THE CURRENTS IN BELLE ISLE STRAIT.<sup>1</sup>

THE behaviour of tidal streams and currents in Belle Isle Strait, described by Dr. Dawson, Superintendent of Tidal Surveys to the Canadian Government, in a number of reports, the latest of which are before us, affords an example of the manner in which the various elements in a complex current may be distinguished one from the other. As the same may apply to other straits where the conditions are similar it should, therefore, be of more than local interest. The current in the strait is primarily tidal in character, and under normal conditions it will turn regularly; the flood running westward, and the ebb eastward with equal velocity. When, however, the moon is in high declination the resulting diurnal inequality causes one flood and one ebb in the day to be twice as strong as the other; the difference being much greater than that between ordinary or average springs and neaps.

In addition to the tidal fluctuations, the water has a tendency to make through the strait in one direction more than the other, thus causing a continuous gain to eastward or westward, as the case may be. The overbalance in one direction which is superimposed upon the usual tide elements to which the term element of *dominant flow* is given, introduces complications, because larger in relation to the strength of the tidal streams, especially at neaps when weak. It may, in fact, be so strong as to reverse the ordinary tidal streams or prevent them from turning, although the fluctuation in velocity be well marked.

The dominant flow, it is stated, cannot be attributed to local wind, because wind would produce merely a surface drift, whereas the dominant flow is that of the whole body of the water. It is, however, apparently

<sup>1</sup> The Currents in the Gulf of St. Lawrence. By Dr. W. Bell Dawson. (Ottawa: Government Printing Bureau, 1913.)