

will not bear comparison with the technical high schools of Germany, either as regards number of students or nature of the instruction. The total number of day technical students in English polytechnics, technical schools, and colleges, and in universities and university colleges recognised as technical institutions by the Board of Education, is about 4000; and less than one-fifth have passed a university matriculation examination or its equivalent upon entrance. Less than 2000 day students are taking full courses of instruction in technical institutions in England and Wales, though this number includes students of technology in several provincial universities or university colleges. The technical high schools of Germany and Zurich have together more than six times as many day students taking full four-year courses, after having completed a full secondary-school course and obtained the leaving certificate. If the same standard were required for entrance to our technical institutions, most of them would cease to exist.

Our position as regards university students is equally unsatisfactory when compared with that of Germany. In the whole of the universities of England, including Oxford and Cambridge, there are about 17,000 full-time students, whereas Germany has four times as many. The University of Berlin alone has 10,000 matriculated students; Leipzig 5000; Bonn, Breslau, and Halle more than 3000 each, and six other universities more than 2000. We have a long journey to make before we can approach the position occupied by Germany as regards secondary, technical, or university education, and it is the State which must take the lead if we are to make up our leeway. The first requirement is to organise our educational institutions into a truly national system; that is to say, upon a system which has the well-being of the nation as its main object, and in which facilities are offered to every individual to secure the highest instruction if he is qualified to take advantage of it.

The raising of the leaving age of elementary schools, the abolition of the "half-time" system, the establishment of compulsory continuation schools, and the coordination of elementary and secondary schools are reforms for which England ought no longer to wait, but of greater importance from the point of view of national progress is the development of higher technological instruction and research in our technical colleges and universities. The importance of this was emphasised by Mr. H. G. Wells in three articles contributed to *The Daily Mail* on April 7, 8, and 9. Mr. Wells's theme was the nature of our naval and military armaments and the national expenditure upon these preparations for war; and he urged that too much confidence is placed in obsolescent instruments of destruction and far too little encouragement given to organised technical research, military and naval experiment, and other means by which a secure position can be obtained by the aid of science. "I will suggest," he said, "that we have the courage to restrain and even to curtail our monstrous outlay upon war material, and that we begin to spend lavishly upon military and naval education and training, upon laboratories and experiment stations, upon chemical and physical research, and all that makes for knowledge and leading, and that we increase our expenditure upon these things as fast as we can up to ten or twelve millions a year." The arts of peace, no less than those of war, require the production of as many highly educated, inventive, investigating men as the nation can obtain from all classes of the community. The future of every modern State depends upon the work of its men of science and engineers. Let us hope that this will not be forgotten when the Government gives attention to the organisation of education,

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and that consideration will be given not only to the acquisition of knowledge by students of various grades, but also to its increase.

R. A. GREGORY.

VARIATIONS IN ATMOSPHERIC CIRCULATION IN TEMPERATE LATITUDES.

DR. A. DEFANT contributes a long paper to the *Sitzungsberichte der K. Akad. der Wiss. in Wien*, March, 1912, in which he discusses the variations in the meteorological elements in temperate latitudes in both hemispheres. In an introductory section he outlines the theoretical conclusions on which he bases his method of investigation. Briefly stated, they are as follows. If a region is a region of rising pressure, a "Steig-gebiet" in the nomenclature of Ekholm, the mean temperature of the atmosphere is below normal, and *vice-versa* if it is a region of falling pressure; but the precipitation is a maximum if the temperature of the atmosphere is above the normal over the region, and a minimum if the temperature is below the normal. Consequently oscillations in the precipitation correspond with oscillations in the variation of pressure, and if the first are periodic, the second will have the same periods.

The argument is ingenious, and would be unquestionably valid if the correlations were complete, but the question naturally suggests itself: "Why not investigate directly the records of pressure, which is less subject to local influences than is the amount of rainfall?" The paper appears to contain no adequate reason against adopting the direct method, but as rainfall is a more important climatic factor than pressure, the results of the investigation have an interest of their own, apart from the theoretical development.

The author has taken the daily weather reports for South America and Australia for the year 1904, added together the published values of rainfall for each day for all stations, and taken the total so obtained to represent the daily rainfall of the region considered. The totals are then written down in series, and the number of maxima during the year is counted and divided into the number of days. In this way an approximate period is obtained. The variation of this period is then eliminated, and the process repeated to give the next period. The method is clearly a rough one, and some discussion of the significance of the periods obtained appears to be necessary. Nevertheless, the results are interesting, and suggest that the application of Schuster's method of analysis to the search for comparatively short periods would repay the labour involved. Defant obtains periods of about seven, twelve, sixteen, and thirty-one days for the southern hemisphere, and by using the values for 1909 finds corresponding periods of about six, thirteen, and twenty-five days in Europe. It may be noted that Turner found evidence of a period of twenty-five days in his analysis of the Greenwich records.

Using some results of Exner's on the effect of the different thermal conditions over land and water, the author finds that a continent is the source of a series of pressure waves which travel from west to east with a velocity independent of the wave-length, and he connects this series of pressure waves with the variation of rainfall. The most important waves are those of which the lengths in degrees of longitude are 360° , 180° , 120° , &c., while next in importance are those of which the length is half the width of a continent or ocean. Their velocity is about 11° of longitude per day in the southern hemisphere, 14.5° per day in the northern. It is clear that if the results of the author's investigations are valid, they will be of great importance in long-distance forecasting.

E. GOLD.