partially supported themselves by work upon the College farm during summer, and during the long winter vacation they taught district schools, thereby earning enough to pay their expenses at College. But conditions in Michigan have very much changed since that time, and the long vacation is not now in winter, as was formerly the case, but in summer. Students, who have not learned the ordinary operations of farm work before entering the College, have to spend one long vacation on the College farm. As the College farm and park cover an area of 676 acres, there is plenty of opportunity to study practical agriculture. The report of the Experimental Station provides the students and the farmers of the State with much useful information. The influence which the Station exerts upon the agriculture of the State may be estimated from the fact that more than 24,000 copies of the bulletins are distributed. These bulletins, which deal with such subjects as "Sugar Beets in Michigan," "Experiments in Corn Raising," "Commercial Fertilisers," "Bacteria and the Dairy," "Feeding Dairy Cows," "Injurious Insects," and "Tuberculosis in Cattle," are in no wise compilations, but records of results of original investigations; their value as a factor in the development of the agriculture of the State must be very important.

SCIENTIFIC SERIALS.

American Journal of Mathematics, vol. xxii. No. 1, January.—Appareil à liquide pour l'intégration graphique de certains types d'équations différentielles, by M. Petrovitch, is a continuation of the article, "Sur l'intégration hydraulique des équations différentielles," by the same author (vol. xx. No. 4). The article describes an apparatus, exceedingly easy to construct, which gives a means of solving certain equations, "intégrables analytiquement, mais il est commode pour les applications d'avoir une methode rapide et sûre pour la construction mécanique de leurs courbes intégrales."—The next paper, proof that there is no simple group whose order lies between 1092 and 2001, by G. H. Ling and G. A. Miller, continues the search begun by Hölder, and carried on by F. N. Cole and Burnside.—T. F. Holgate contributes a note additional to a former paper on certain ruled surfaces of the fourth order. The surface for which the nodal lines are real and distinct, F_5^4, and that for which the nodal lines are coincident, F_6^4, were previously discussed, but no mention was made of the surface for which the nodal lines are imaginary, though the existence of such a surface must have been in mind at the time. From the geometrical standpoint a study of the separate surfaces is of considerable interest.—H. F. Stecker's non-Euclidian properties of plane cubics is an interesting discussion on the lines of Clifford and Story.—Dr. E. O. Lovett gives two notes (1) on the differential invariants of Goursat and Painlevé, and (2) a supplementary note on projective invariants (see the April No. of the last volume).—Certain sub-groups of the Betti-Mathieu group is a slight addition to a dissertation by Dr. L. E. Dickson (*Annals of Mathematics*, 1897; *cf.* also the July No. (1899) of the *American Journal*).—Dr. W. H. Metzger gives a brief note on the excess of the number of combinations in a set which have an even number of inversions over those which have an odd number.—On Lie's theory of continuous groups, by E. W. Rettger, following up Study's and Taber's work, investigates the two- and three-parameter sub-groups of the general projective group in two variables, and of the general homogeneous linear groups in three variables, enumerated by Lie on pp. 288, 519 of his *Continuerliche Gruppen*, and his aim is to show that singular transformations occur among the transformations of many of these sub-groups.—V. Snyder writes on lines of curvature on annular surfaces having two spherical directrices. Several interesting geometrical results are given.

Symons's Monthly Meteorological Magazine, February.—Climatological records for the British Empire for 1898. Of the eighteen representative stations from which observations are regularly received, the highest shade temperature was recorded at Adelaide, 113°·3 on January 11, and the lowest at Winnipeg, −34°·6 on December 31, with the greatest range in the year, 126°·1, the least being at Grenada, 19°·8. The driest station was Adelaide, mean humidity 59, and the dampest place, Colombo (Ceylon) and Trinidad, mean humidity 80. Adelaide also registered the highest temperature in the sun, 173°·7. The greatest rainfall occurred at Colombo, 103·1 inches, and the least, 15·6 inches, at Melbourne. The most cloudy place was London, the average amount being 6·4. The table shows a remarkable similarity to that for 1897; there are only three changes in the summary of extreme values. Malta, in 1898, had a rainfall (29·2 inches) nearly ten inches above the average of 15 years, and probably the greatest on record.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society.—Special meeting held by invitation of Prof. Callendar in the Physical Laboratory of University College, March 2.—Prof. G. Carey Foster, F.R.S., Vice-President, in the chair.—Dr. F. G. Donnan read a paper on the relative rates of effusion of argon, helium, and other gases. The introduction to this paper contains a short account of the work which has been done on the effusion of gases. This is followed by a theoretical investigation of the subject, upon the assumption that the ideal gas laws are obeyed, and that the back pressure never rises above a certain fraction of the internal pressure. This gives rise to formulæ which are different from the square root of the density law of Graham. The formula derived from Hugoniot and Reynold's work gives the ratio of the times of effusion of two gases whose specific heat ratios are 1·408 and 1·67, equal to 1·06 times the square root of the ratio of the densities. The constant derived from Parenty's work is 1·084. The theory therefore indicates that argon should effuse faster than would be calculated from Graham's law. The gases used were oxygen, hydrogen, nitrogen, carbon-mon-oxide, carbon-di-oxide, cyanogen, argon and helium, and they effused through small holes pierced in platinum foil. When the holes are large compared with molecular dimensions the phenomenon is one of efflux on a small scale. In the actual experiments this was the case, although the holes were sufficiently small to cause appreciable viscosity effects. By employing two or more observations in conjunction with the relative viscosities of the gases used, an apparatus constant was determined which allowed these effects to be eliminated. The observations showed that argon effused 3½ per cent. faster than as calculated from the densities alone. This agrees qualitatively with theory, and affords a confirmation of the high specific heat ratio of argon. Hydrogen, oxygen and carbon-mon-oxide effuse in the manner predicted by the theory for gases having the same, or nearly the same, specific heat ratios. Carbon-di-oxide when compared with oxygen appears to effuse 1 per cent. faster than as calculated from the densities. This result is not in accordance with the adiabatic theory of the efflux of ideal gases. The results for helium are not uniform, but show that its behaviour is unlike that of argon, a result not foreseen by the theory. If account be taken of the deviation of ordinary gases from the ideal laws, it is possible to obtain an expression for the efflux which contains a correction term involving the constant K of the Joule-Thomson effect. The sign of this correction term shows that a real gas will effuse more rapidly or more slowly than an ideal gas of equal density and specific heat ratio, according as K is positive or negative. The suggestion is made that possibly the anomalous results obtained with carbon dioxide and helium may be thus explained. The deviations of the observed results from the results calculated for an ideal gas are, in the case of carbon dioxide, in qualitative agreement with the theory proposed. In the case of helium, they would be so if that gas possesses a negative K.—Lord Rayleigh congratulated the author, and pointed out that in the case of very small apertures the gas laws might not be obeyed. The ratio of the dimensions of the aperture to the length of the mean free path determined this, and not the ratio of aperture to molecular dimensions.—Prof. Ramsay and Prof. Everett expressed their interest in the work.—Dr. Donnan thanked Lord Rayleigh for his correction, and stated that the apertures used were about $\frac{1}{50}$ mm. in diameter.—Mr. E. C. C. Baly read a paper on the distillation of liquid air and the composition of the gaseous and liquid phases. From the experiments described in this paper, the author has drawn curves showing the relation between the composition of the gas evolved by boiling liquid air and the temperature, and between the composition of the liquid and the temperature, both at constant (atmospheric) pressure. These curves enable the temperature of boiling liquid air to be at once accurately determined by means of an analysis either of the liquid or of the gas evolved. The measurements of temperature