

without a definite solution. Messrs. M. Padoa and B. Savarè in the *Gazzetta* (vol. xxxvi., p. 310) have attacked the problem in a new way by investigating the change in the electrical conductivity of a solution of iodine in potassium iodide caused by the addition of starch in known proportions. The conclusion is drawn from their experiments that the blue substance is an additive compound of iodine, starch, and potassium iodide (or hydrogen iodide) containing the two former constituents in the ratio 1 : C₆H₁₀O₅ = 1 : 4. While this result supports the opinion of Mylius, enunciated some twenty years ago, it is directly opposed to the more recent view of Küster that the blue substance is not a definite substance, but is formed as a result of adsorption by the colloid starch. Küster's contention recently received striking support by the work of Biltz in 1904, who showed that basic lanthanum acetate, which resembles starch in its colloidal nature, also produces with iodine an intensely blue substance similar in all respects to that formed from starch; in this case there seems to be no evidence to consider the substance as a definite chemical compound.

THE current issues of the *Lancet* and the *British Medical Journal* are educational numbers, and are entirely devoted to communications bearing upon preparation for the medical profession.

THE Royal Geographical Society has issued through Mr. E. Stanford a general index to the first twenty volumes of the *Geographical Journal*, 1893-1902. The work, which is divided into three parts, devoted respectively to papers, maps, and general subjects, should prove a boon to geographers.

The third edition of Prof. R. von Wettstein's "Leitfaden der Botanik für die oberen Klassen der Mittelschulen" has just been published by Mr. F. Tempsky, Vienna. The book contains 236 pages, more than half of which (134 pages) are devoted to systematic botany, while the remaining sections deal with plant anatomy, organography, physiology and ecology, geography, and economic botany. There are three coloured plates and more than a thousand figures upon 205 blocks. Within its limits, the work makes an admirable survey of the realm of botany, being attractive in illustration, concise in description, and sound in substance.

OUR ASTRONOMICAL COLUMN.

RETURN OF HOLMES'S COMET (1906f).—The remarkable comet discovered by Mr. Holmes on November 2, 1892, has been re-discovered on this, its second, return by Dr. Max Wolf at the Königstuhl Observatory, Heidelberg. From the Kiel telegram announcing this fact we learn that on August 28, the date of the observation, the comet's position at 13h. 52.1m. (Königstuhl M.T.) was

R.A. = 4h. 7m. 24s., dec. = +42° 28'.

This position is between one-third and one-half the distance between 52 and 53 Persei, and crosses our meridian at about 5.30 a.m.

Comparing the position with that given by the ephemeris published by Dr. H. J. Zwiers in No. 4085 of the *Astronomische Nachrichten*, we find that small corrections of about +0.5m. in R.A. and +3'.5 in declination need to be applied to the latter. A portion of this ephemeris is given hereunder:—

Ephemeris oh. (M.T. Greenwich).					
1906	α (app.) h. m.	δ (app.)	1906	α (app.) h. m.	δ (app.)
Sept. 6 ...	4 17 ...	+44 6	Sept. 14 ...	4 25 ...	+45 34
8 ...	4 19 ...	+44 29	16 ...	4 26 ...	+45 56
10 ...	4 21 ...	+44 51	18 ...	4 28 ...	+46 17
12 ...	4 23 ...	+45 12	20 ...	4 29 ...	+46 38

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COMET 1906e (KOPFF).—Circular No. 90 from the Kiel Centralstelle gives three ephemerides for the comet recently discovered by Herr Kopff at Heidelberg. The following was computed by Herr M. Ebell:—

Ephemeris 12h. (Berlin M.T.).						
1906	h.	m.	s.	δ	log Δ	Brightness
Sept. 4 ...	22	39	58 ...	+9 36'.0 ...	0.0490 ...	0.75
8 ...	22	37	19 ...	+9 14'.9 ...	0.0639 ...	0.67
12 ...	22	34	57 ...	+8 52'.0 ...	0.0797 ...	0.60
16 ...	22	32	55 ...	+8 28'.1 ...	0.0961 ...	0.54

Several observations of this comet are recorded in No. 4117 of the *Astronomische Nachrichten*. Prof. Kobold, observing at Kiel on August 23, saw it as an undecided, round spot of 2' diameter with a central condensation of magnitude 11.0. The magnitude of the whole was 10.5. From an observation, also made on August 23, Prof. Hartwig described it as having a diameter of 1'.5, a nucleus of magnitude 13.0, and a round shape, the total magnitude being 12.0.

A NEWLY-DISCOVERED PLANETARY NEBULA.—On examining one of the plates taken with the 10-inch Brashear lens of the Bruce photographic telescope, Prof. Barnard discovered the image of a fine planetary nebula which does not appear to be in the catalogues. The approximate position of the nebula, for 1855, is α=11h. 7m., δ=+15° 42'. In the same region there appear to be quite a number of spiral nebulae and nebulous stars (*Astronomische Nachrichten*, No. 4112).

PLEA FOR AN INTERNATIONAL SOUTHERN TELESCOPE.—In No. 182, vol. xlv., of the Proceedings of the American Philosophical Society Prof. E. C. Pickering advances a businesslike plea for the institution of a large international reflector in the southern hemisphere. He points out that, under the existing conditions, it is hard to see how any great step may be made in the advance of astronomy, but thinks that if a reflector of about 7 feet aperture and 44 feet focal length were erected in the best possible atmosphere to be found in the southern hemisphere, advances of immense importance might accrue. The cost he estimates at something less than 500,000 dollars (rather more than 100,000l.), and he suggests that such a scheme would be an eminently suitable one by which to commemorate the Franklin bi-centenary.

THE PROGRESS OF AGRICULTURAL SCIENCE.

THREE years ago the Royal Agricultural Society conceived the happy idea of holding, in connection with its annual shows, an agricultural education exhibition, at which the work of the various agricultural colleges might be brought prominently before the public, and especially the latest results of agricultural scientific research. The fourth annual exhibition of this kind was recently held at Derby, and the object of this note is to indicate several of the more important directions which agricultural research and rural education are now taking, and the results as illustrated at the exhibition.

Mendel's Laws of Inheritance.

Important hybridising experiments on the lines of Mendel's laws of inheritance are being carried out at the Cambridge University Agricultural Department by Mr. R. H. Biffen. Mendel's laws prove the recurrence in breeding of dominant and recessive characters in certain definite proportions, and their application renders possible the production of new fixed types in two or three generations with mathematical precision instead of as formerly after years of more or less haphazard breeding by selection. Thus in crossing smooth red with rough white wheat, the first cross was apparently of fixed type; but in the second generation only one out of sixteen bred true; in the third generation three bred true; in the fourth generation four bred true, and the type was fixed. The same principles are applicable to the inheritance of disease. Rows of wheats were shown proving the possibility of

obtaining in three or four generations immunity from rust in specimens the original parents of which were of rust-susceptible and rust-resisting types. Very interesting is the application of these laws to the breeding of animals. Mr. W. Bateson, F.R.S., and Mr. R. C. Punnett, of Caius College, Cambridge, lent some preserved bodies of Andalusian and rosecomb bantam fowls. The blue Andalusian never breeds true, but always produces a definite proportion of blacks and splashed whites. From a pen of blues, one-half of the offspring will be blue, one-quarter black, and one-quarter white. When blue is mated with either blue, black, or white, one-half of the offspring will be blue. When, however, black is mated with white, all the offspring are blue. In reality, the blacks and whites are both pure breeds, and the blue is the hybrid form produced by crossing these breeds. It is therefore so constituted that it cannot breed true, and no amount of selection will ever bring about this result. White rosecomb bantams belong to the class of recessive whites, and the progeny of a white rosecomb by any pure-coloured breed are always coloured. Thus when a black and a white rosecomb are crossed, all the hybrids are black. When such hybrids are mated together, three-quarters of the chicks are black and the rest white. In Mendelian terms the black is dominant and the white recessive. There are, therefore, two kinds of blacks, those which carry whites and those which do not. When crossed with white the former give equal numbers of blacks and whites, whilst the latter give blacks only. It is, however, impossible to distinguish between the two kinds of black, except by a breeding test, the eventual result of which is the production of blacks and whites, both of which breed true to colour.

Assimilation of Nitrogen by Leguminous Plants.

The nitrogen problem has received special attention at the Midland Agricultural and Dairy College, and recently experiments have been made with the pure inoculation cultures of Dr. Hiltner, of Munich. Tares, peas, alsike, lucerne, and crimson clover (*Trifolium incarnatum*) were sown in pots of boiled, sterilised, quartz sand, and the effect of inoculating the soil in these pots with the pure cultures supplied by Dr. Hiltner was shown to have decidedly beneficial effects upon the growing plants. Mr. John Golding, by whom these experiments have been carried out, has introduced a new system of inoculation for leguminous crops, which consists in mixing dried sterilised soil with crushed healthy nodules taken from the roots of plants of the same kind as those which it is desired to inoculate. The object of sterilising the soil is to effect the destruction of harmful germs and pests such as the wireworm, &c. Buhler has shown that the microbes of the leguminous nodules all belong to one species, but are modified so that nodules coming from a particular leguminous plant are those best adapted for inoculation of the soil in which that plant is sown. Mr. Golding's inoculating material will contain, therefore, only the microbe of value for the particular plant cultivated. If this material should prove practically efficacious on a field scale, it can be supplied at a cost of from 1d. to 2d. per lb., which at the rate of an application of 56 lb. per acre represents a cost per acre of from 4s. 8d. to 9s. 4d.

Vitality of Farm Seeds.

This question has received practical elucidation from experiments carried out during the last eleven years by Mr. William Carruthers, F.R.S., consulting botanist to the Royal Agricultural Society. The results were illustrated at Derby by a large table, which showed in respect of all the farm seeds in common use the percentage of living seeds remaining each year from the commencement of the experiments in 1885 to the present year (1906). Of the cereals, oats proved to have the greatest vitality. Black oats retained 76 per cent., and white oats 57 per cent., of living seeds in the eleventh year (1906), whilst in the ninth year (1904) the percentage was no less than 95 per cent. and 97 per cent. Wheat in the ninth year showed a germinating power of 29 per cent., but none remained alive in the tenth year. Barley retained vitality to the

extent of 90 per cent. in the fifth year (1890) and 19 per cent. in the tenth year (1904), but none remained alive in the tenth year. Grasses were proved to lose their vitality very much more quickly than the cereals. Sheep's fescue, for instance, was reduced by one-half its germinating power by the third year, and all the seeds were dead by the eighth year (1903). Of Timothy, 93 per cent. remained alive in the fifth year and 12 per cent. in the eleventh year. Crested dog's tail germinated 61 per cent. in the fifth year and 11 per cent. in the eleventh year. Of the rye grasses, in the seventh year the perennial and Italian rye grasses germinated 36 per cent. and 71 per cent., and in the eleventh year 6 per cent. and 10 per cent., respectively. Of the root crops, swede turnips retained their vitality almost unimpaired for the first three years, and even up to the seventh year the germination was from 84 per cent. to 85 per cent.

Improvement of Pastures.

The increasing importance of dairying has led to the renovation of a great deal of poor pasture. No small part of the work of some of the agricultural colleges has been devoted to a study of the remedies appropriate to different conditions, whilst from 1885 to 1904 a series of experiments on the improvement of grass lands in various parts of the country was carried out by the Royal Agricultural Society. The results of these experiments were illustrated by turfs cut from the actual pastures, and they brought before the farmers who visited the show lessons of supreme practical importance. In a turf sent by the Royal Agricultural Society, and cut from a pasture in Yorkshire, the application of lime was shown to have been remarkably beneficial, and the dividing line between limed and unlimed portions was clearly indicated by the difference in the character of the herbage. This turf was from land where basic slag without lime had no appreciable effect. On the other hand, turf sent by the Cambridge University Agricultural Department from land of the Boulder-clay formation proved the necessity for the application of phosphates, and basic slag was the appropriate remedy. Lime and cake-feeding in these cases proved of no avail. Turfs sent by the Royal Agricultural College showed that the addition of kainit and superphosphate resulted in a large increase of clover, and a large reduction of moss and undecayed vegetable matter that were conspicuous in the unimproved pasture. The character of the herbage was also shown to be materially influenced by other applications, such as sulphate of ammonia and nitrate of soda, while the use of 5 cwt. per acre of guano—a natural complete manure—produced a decided improvement, the abundance of white clover and sheep's fescue providing splendid food for sheep.

British Forestry.

The exhibits consisted of seeds, cones, trees, shrubs, timbers, tools, photographs, specimens, models, diagrams, working plans, and maps. They were arranged under the supervision of members of the council of the Royal English Arboricultural Society. The Duke of Northumberland, Earl Egerton of Tatton, the Earl of Egmont, and the Earl of Yarborough sent timber specimens showing the economic uses to which British plantations may be applied, and illustrating methods of preservation, chiefly by creosoting. Lord Yarborough's woods have been scientifically managed for a long period, and a chart was displayed showing that 23,564,719 trees have been planted on the Brocklesby and Manby Estates from the year 1700 to the present time. An exhibit sent by the Duke of Northumberland consisted of young trees planted out of doors, and showing the mixture of light-demanding and shade-bearing trees according to the following plan, as adopted in Germany:—(a) outer row of beech providing shelter; (b) second row with sprinkling of sycamore as a wind-resister; (c) oaks, 9 feet apart, for permanent crop; (d) other hardwood trees for returns during rotation; (e) sprinkling of larch for early returns; (f) shade-bearers of spruce, silver fir, and beech for soil production and stimulation of main crop. Several exhibits illustrated the evils arising from incorrect pruning or from neglect of pruning. Where pruning is not effected

close to the stem, the projecting stump decays, and the decay affects the trunk. Where branches are not pruned at all, or not at the right time, natural pruning caused by thick planting occurs, but the decay of the branches also affects the trunk. Too early thinning prevents the growth of clean boles with suppressed branches. All these points require careful attention in forestry, or considerable depreciation in the value of the timber ensues. The Royal Agricultural Society, the Royal Agricultural College, the Surveyors' Institution, and Mr. A. T. Gillanders (forester to the Duke of Northumberland) sent collections of mounted specimens of insects injurious to forest trees. Those of Mr. Gillanders were very complete, and were classified as beetles, saw-flies, moths, scale insects, aphidæ, and diptera.

Nature-study in Rural Schools.

This, a new feature, was by no means the least interesting department of this year's exhibition. It was organised by the County Councils Association, and was divided into groups of exhibits from public elementary schools, secondary schools, and school gardens. The counties from which exhibits were sent included Cambridge, Cumberland, Durham, Derby, Essex, Leicester, Lincoln, Nottingham, Stafford, Suffolk, Sussex, and Worcester, and the work sent was highly creditable to both teachers and scholars. It was stated that the specimens were collected and mounted by pupils of average intelligence, but the excellence of many of the water-colour drawings of common flowers was remarkable. The collections made by the scholars included mounted specimens of local flowering plants, some of them classified into hedge-row, wood, and water plants, collections of tree leaves, autumn fruits, fossils, common insects, snails, wireworms, &c. In the secondary schools the work was, of course, more advanced, and included classification into seeds, seedlings, branches, flowers, fruits, and wood in the case of common trees. The Staffordshire County Council exhibited collections of tools, seeds, and apparatus as supplied to school gardens, and a map showing that gardening classes are held in seventy-nine day schools, in thirty evening schools, and two grammar schools in that county. The introduction of nature-study into our rural schools appears to hold out great promise as a means of training and developing the intelligence of country children. It should go far to counteract that "dulness of the country" which is stated to be one of the potent causes of migration to the towns. Education of the youthful mind to the intelligent appreciation of natural phenomena may be regarded as a most important means of ensuring the future progress of agricultural science.

E. H. G.

RUSSIAN GEOGRAPHICAL WORKS.

SEVERAL papers and memoirs of scientific interest and importance are included in publications received from Russia during the past few months. The publications are printed in the Russian language, and among them are four volumes of the Proceedings of the Imperial Russian Geographical Society.

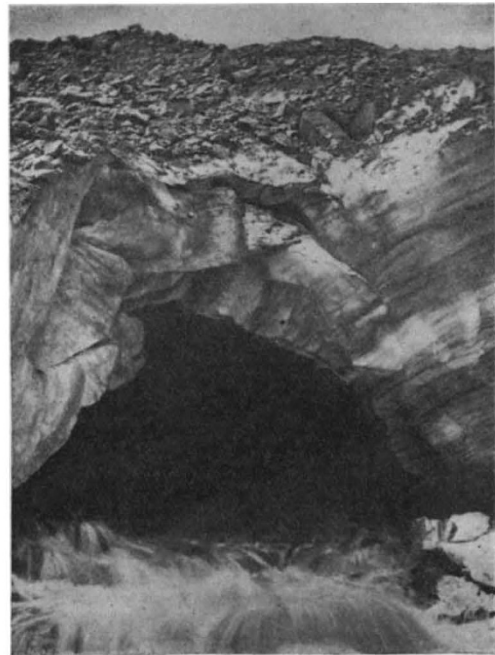
In vol. xli., part iv., of the Proceedings of this society, Mr. V. V. Markovitch contributes lengthy articles, one entitled "In Search of Eternal Ice," and the other on the ice-fields of the Caucasus, illustrated with beautiful photographs and sketches. Botanists will be interested in his notes on the flora of the mountains. Elaborate reports on the subject of ground ice, by a commission appointed to study the question, appear in the Proceedings, vol. xli., part ii. A map of European Russia is given, indicating results of investigations by many observers. In vol. xl., part iv., an important examination by Mr. A. I. Voieikoff of the question whether the Pacific Ocean will become the chief commercial route of the terrestrial globe appears, with statistics and maps.

In vol. xli., part iii., Mr. L. Berg differs from Prince P. Kropotkin's opinions on progressive desiccation of Eur-Asia, maintaining that the climatic conditions of Central Asia have been practically unchanged from the earliest recorded times, and that geological desiccation has long ceased. Mr. Berg refers to a canal called after Hammurabi

(Amraphel, King of Shinar), a passage in the "Song of Songs" about the cessation of winter and stoppage of rains, a plant crowning the mummy of an Egyptian princess, Quintus Curtius's account of Bactria in the time of Alexander, down to the investigations of Heim, Hess, Bruckner, and Russian explorers. The writer adduces his experiences of the Aral region in support of his conclusions.

In 1896, 1897, and 1899 Mr. N. A. Busch was commissioned by the Imperial Russian Geographical Society to investigate the glaciers of the western Caucasus, Kuban district, and Sukhum circle. The results are recorded in his report, "Glaciers of the Western Caucasus," 1905 (134 pages), which is furnished with a helpful index and some fine views.

A work entitled "Materials for the Geography of the Urals," by Mr. P. Krotov, describes orohydrographical investigations in the southern part of the central Ural range. The preface opens with a reference to Dr. Carl Hieckisch's work "Das System des Urals" (Dorpat, 1882), to show that knowledge of the geography of these regions is meagre and superficial owing to lack of expenditure of money and exertion. It is claimed that the northern and



Ice-cave of the right glacier of the Tsherin-kol.

southern parts of the range are more familiar to scientific explorers than the more accessible central part. In 1893 it was decided to make an orohydrographical survey of portions of the Ekaterinburg and Krasnoufimsky districts, Perm government, but the area proposed was afterwards limited. Mr. Krotov reviews previous explorations, mentioning, *inter alia*, the labours of Tatistsheff, Humboldt, and Murchison.

The six chapters contain:—historical sketch of previous explorations; cartographical materials and geological sketch; orographical description; hypsometry of the western slope of the Urals; hydrographical description; concluding notes; "absolute heights" in the southern part of the central Urals; forty-two pages of lists of heights. Orographical and geological charts are given at the end on a scale of five *verst*s to the inch.

The report of the Imperial Russian Geographical Society for the year 1904 contains a vast amount of useful matter, especially in the records of scientific exploration. Following the official lists there are short biographies of deceased members, including General P. S. Vannovsky and Admiral S. O. Makaroff, medallist, constructor of the ice-breaker *Yermak*.