from Scotland, presented by Mr. J. Faed; a Great American Heron (*Ardea herodias*), captured at sea off Cuba, purchased; a Ruddy-headed Goose (*Bernicla rubidiceps*), bred in the Gardens. The following species of Butterflies and Moths have been exhibited in the Insect House during the past week:—Silkmoths: *Samia cecropia, Attacus cynthia, Attacus pernyi, Attacus atlas, Attacus roylei, Actias selene, Actias luna, Cricula trifenestrata;* Butterflies: *Papilio machaon, Anthocharis cardamines, Thais polyxena, Melitæa cinxia;* Moths: *Smerinthus ocellatus, Chærocampa elpenor, Proserpinus œnotheræ, Sesia scoliæformis, Sesia spheciformis, Trochilium apiforme, Sciapteron tabaniforme, Pygæra bucephala.* Twelve specimens of a leaf insect (*Phyllium scythe*) from eggs transmitted by Mrs. M. A. Meres and Mr. Wood Mason from India, have also emerged.

OUR ASTRONOMICAL COLUMN

THE TRAPEZIUM OF ORION.—Prof. Holden, in an appendix to the Washington observations for 1877, has discussed a long series of measures of the multiple star Σ 748, made with the 26-inch refractor by Prof. Asaph Hall in 1877 and 1878. It is now known that the nebula in Orion was discovered by Cysat in 1618, thirty-eight years before Huyghens published an account of it, and his discovery is mentioned in his "Mathemeta Astronomica de Cometi Anni, 1618"; Bessel refers to it in his investigation of the elements of the great comet of this year, in the *Berliner Jahrbuch* for 1808. Cysat does not distinctly mention the number of stars, but clearly indicates their locality. Huyghens, in the "Systema Saturnium," 1659, describes his own discovery of the nebula, and refers to "three stars close together," which are shown in an accompanying figure. He saw the fourth star, completing what is now known as the trapezium of Orion on January 8, 1684, and Prof. Holden records that the last observation made by Huyghens was upon this system, on February 4, 1694, and the sketch in his manuscript journal under that date gives the four stars. In Hooke's "Micrographia," published in 1665, is a note (to which the attention of the American astronomer was drawn by Mr. H. B. Wheatley), which would imply that he was aware of the existence of the fourth star (notified by Cassini in his treatise on the comet of 1652), and of the fifth star, the discovery of which is usually attributed to W. Struve. He writes: "In that notable asterism also of the sword of Orion where the ingenious Monsieur Hugens van Zulichem has discovered only three little stars in a cluster, I have, with a 36-foot glass, without any aperture [diaphram] (the breadth of the glass being some three inches and a half), discovered five, and the twinkling of divers others up and down in divers parts of that small milky cloud." Sir John Herschel, in the *Memoirs* of the Royal Astronomical Society, vol. iii. mentions that Sir James South had pointed out to him in the original M.S. journals of the Royal Society a note which runs thus: "September 7, 1664 Mr. Hooke . . . the same relateth to have found those stars in Orion's belt, which M. de Zulichem maketh but three to be five." Prof. Holden made some special experiments in January, 1878, with the 26-inch refractor at Washington, the aperture reduced to 3½ inches, and arrived at the conclusion that if the fifth star were of the same brightness in 1664 as at this time, it would not have been discovered by Hooke; but, on the contrary, Mr. Burnham has brought together a number of cases in which the fifth star has been seen recently with such an aperture. The sixth star was detected by Sir John Herschel in 1830. Of other stars, suspected by several observers, Prof. Holden, during six years' observations of the nebula surrounding the trapezium, has not discovered any trace.

The Washington measures in 1877 were made in a dark field with the wires illuminated by a red-glass lamp; those of 1878 were made with the field illuminated, and with black wires. The mean results of the two years' observations of the four principal stars, after a complete reduction, are as follow, for the epoch 1878·0:—

	Position.	Distance.		Position.	Distance.
	° ′	″		° ′	″
ab ...	311 7·2	... 13·118	*bc* ...	95 37·1	... 21·758
ac ...	61 9·8	... 13·454	*bd* ...	32 57·7	... 8·774
ad ...	342 18·4	... 16·773	*cd* ...	299 21·0	... 19·364

The results obtained by South in 1820, W. Struve in 1836, Liaponoff in 1849, O. Struve in 1870, Nobile in 1876, and Jedrzjewicz for 1878, are brought together for comparison in Prof. Holden's paper.

Measures of the fifth and sixth stars in 1877-78, give the positions and distances subjoined, for 1878·0:—

		°		″
a and *a′*	...	121 25·2	...	3·984
a and *b′*	...	320 43·3	...	16·504
b and *b′*	...	352 8·0	...	4·194

In conclusion, Prof. Holden remarks: "It appears that after making due allowance for the unavoidable, accidental, and systematic errors, the comparison of all our measures on the six stars of this system shows their probable physical association."

THE COMET.—During the last fortnight the increase in the brightness of the present comet appears not to have differed sensibly from that indicated by theory. On May 21 it was hardly below 5·5m.

GEOGRAPHICAL NOTES

AT the Anniversary Meeting of the Royal Geographical Society on Monday, the medals were presented, as we said some time ago they would be, to Dr. Nachtigal and Sir John Kirk. Mr. Francis Galton gave some account of the progress of geographical teaching in schools, which the Society endeavours to promote by holding examinations and the grant of medals, &c. He quoted a passage from the report of the examiner, Prof. H. N. Moseley:—"I have," Prof. Moseley says, "to congratulate the society on the good work effected by its annual award of school medals. As my experience as an examiner in geography increases, the more I am convinced of its pre-eminent fitness as a subject of education, and the more I deplore that it is almost entirely neglected as such in this country. Competent teachers of the subject appear to be scarce indeed, but it is amply apparent from the society's examinations that most valuable results can be produced by really able instructors." This was the fourteenth year in which these examinations had been held, and fifty-six medals—four annually—had been awarded, while altogether ninety-eight boys had obtained honourable mention. Of fifty-two schools invited to compete, forty-one had sent up candidates. Among these the Liverpool School had been distinguished, its scholars having gained medals fifteen times; while Dulwich had obtained eleven medals since 1875, and two in each of the last three years. In the Scotch and Irish schools the boys were younger than in the high schools of this country, and that accounted, perhaps, for the fact that of five Scotch and seven Irish schools invited to compete, only two in each country had accepted the invitation. He regretted that the great schools of Rugby, Shrewsbury, King's College School, and St. Paul's School, London, had not yet sent competitors. The president then reviewed the progress of geography during the past year. He referred to various efforts which were being made to train those who might have opportunities of pursuing geographical research. Sir Allen Young, the president stated, was busy getting ready the whaler *Hope*, which he has hired, for the search for Mr. Leigh Smith and his party.

WE referred some weeks ago to the unusually early date at which ice appeared in the Atlantic this year; the supply has gone on unceasingly since, and the New York correspondent of the *Standard* states that the reports made by ships coming westward read like accounts of Arctic explorations:—One ship passed icebergs almost daily between May 7 and 17, in latitude 43 deg., longitude 37 deg. Many were of immense size, and were visible for forty miles, others were within arm's length of the ship's side. Arctic animals were seen upon them, some living, and others skeletons. The Atlas liner *Ailsa*, from Aspinwall, reports that in the middle of the afternoon of the 7th it was dark, and lights were necessary. Ten waterspouts were observed whirling in dangerous proximity to the ship. They were rendered visible by the lightning. The captain of her Majesty's ship *Tenedos* reports that the ice is nearly solid from Cape Breton to Newfoundland, and that two ocean steamers have been caught in it. The brigantine *Rescue* was completely crushed near Belle Isle. The crew, numbering seventy-two, took to the ice, although there was a heavy rolling swell surging among the floes. A perilous passage was made by the steamship *Mastiff*, of Scotland, which has arrived at Montreal. She was among the ice for nine days. The crew and passengers, becoming desperate, cut a passage through the ice, which was sometimes twenty feet above the water. Another ship, the *Western Belle*, from Greenock, struck an iceberg off Newfoundland on May 1, and sank instantly with her captain (Frew) and thirteen hands.

HEFT V. of Petermann's *Mittheilungen* contains a long account, by Dr. Woeikof, of his journey in Mexico and Central

America; a paper of much interest by Dr. Konrad Jarz on the ice caves of Frain in Moravia; a short account, from the Russian of Fetisoff, of the Jashil Kul or Kulduk Lake in Central Asia (40° 45′ N., 76° 42′ E.); and some account of the Fiji Islands, to accompany an excellent new map of the group.

BARON NORDENSKJÖLD has published the first volume of the "Scientific Results of the *Vega* Expedition." It covers 800 pages with maps and tables. Besides the papers on the Aurora, of which we have already given an account, there are papers on the Health of the Expedition, the Colour Sense of the Chukchis, on the Botanical Collections, Meteorological Observations, the Invertebrata of the Arctic Seas, and other matters, by the various members of the expedition.

MESSRS. MACMILLAN AND CO. have published a sixpenny edition of Waterton's famous "Wanderings in South America," with the biographical introduction and explanatory index of the Rev. J. G. Wood, and 100 illustrations.

CAPT. BURTON and Commander Cameron have returned to England from their visit to the West Coast of Africa.

THE Geological Society of Stockholm will send a party to Spitzbergen this summer for the geological survey of that island. The two members selected for this object are the well-known geologists, Dr. Nathorst and Baron de Geer, who will leave Drontheim on June 1 in the whaling smack *Bjona* for their destination.

FOOD-PLANT IMPROVEMENT [1]

THE food question may be divided into two parts. 1. Its production (raw material). 2. Its preparation when produced. It is my intention to consider the first part only—food production. This, again, seems naturally to divide itself into: 1. Plant-food. 2. Animal food. And again, I propose to speak mainly of the first alone, alluding only incidentally to animal-food, upon which I will commence by making what remarks I have to make in order to clear the ground for the consideration of *plant*-food, the subject upon which I have been invited to address you. The improvement effected in the production of animal-food by the careful breeding or long repeated selection of sheep, cattle, and swine is so well known as to render it quite unnecessary to occupy much of our time in its consideration; I will only adduce one or two striking illustrations to show the *kind* of change which has been thereby accomplished. There is very strong ground for believing that the celebrated improved breed of shorthorn cattle is descended from a race originally black. Now black seems to have been in the eyes of all the best breeders of it a colour to be got rid of or wiped out, and this most certainly has been effected, for no single instance of it is now to be found. The improvement in the outward form of the animals has been carried almost to the breeders' ideal of perfection. These are external changes. Early in the history of shorthorns the breeders in Yorkshire made the production of milk their chief point, while those in Durham saved for breeding purposes the progeny of those cows only which showed the greatest tendency to lay on meat, and the result is the "Improved Durham," the pride and glory of the modern cattle show, but which are very poor milkers; while the "York" shorthorn is synonymous with a cow specially productive of milk. These are internal changes effected in *animals* by selection. When we turn to plants what do we find? The first thing, aud which is apparent to everyone, is that each produces "fruit after its kind." But close observation shows something more than this, viz. that, although each produces "after its kind," no two plants of any kind are absolutely alike. I speak not of monstrosities, of which the characteristics are not heritable, but of that ever present tendency throughout nature to variation, of which the horticulturist has availed himself. These variations, of which we can profit through the great principle of inheritance are generally slight, so much so, indeed, as to be quite inappreciable by the untrained eye or hand, but they are, nevertheless, striking enough to one competent to observe them. I will give a familiar illustration of this. Nothing can well seem more alike to an ordinary person than the sheep composing a well-bred flock, but the shepherd knows them all apart as well as if each had a name. To him they are no more "all just alike" than are the members of his own family. That these differences, apparently so slight, can be practically availed of, the existing improved breeds of sheep prove beyond doubt. I have already said that no two plants are absolutely alike. Of any two, then, one must be (in the direction of the difference between them) superior to the other. This fact, coupled with the principle of inheritance, is the very key-note of all possible plant-improvement. But, it may be asked, do plants offer opportunity of improvement by breeding equal to that presented by animals? Surely much greater. A cow or ewe produces at a birth one (or two) only—a single grain of wheat has produced a plant, the ears upon which contained 8000 grains all capable of reproduction. Now we can plant all these, and of the resultant 8000 plants reserve only the best one of all to perpetuate the race, rejecting every other. Can anything approaching such a choice as this be afforded any breeder of cattle or sheep, no matter how extensive his herd or flock? The advantage on the side of the wheat becomes almost infinite when it is considered that in the case of the above animals three years (instead of one) are required for each reproduction.

Before giving a few examples of results already obtained in cereal development, I will mention analogous improvements obtained in vines and in beetroot cultivated for sugar. Many years ago an old friend from Piedmont, having a relative a vine grower in Italy, carried back with him from here a sufficient knowledge of my system of selection to enable him to explain its principle. Some seven years after, upon my friend again visiting me, he told me that his relative, knowing him to be in London, had written to ask him if he could arrange there for the disposal of his wine, and that he, without reading this letter through, at once replied in the affirmative. This he did, as he knew the small extent of his relative's vineyard—some 12 acres. "You may judge of my astonishment," said this gentleman to me, "when upon reading his letter to the end, I found that he had, without having increased the extent of his vineyard, three times the quantity of wine he formerly produced, and this simply through having followed the plan of selection I had suggested to him." The cultivation of beetroot for sugar is a very important one, and any increase in the percentage of sugar contained in it is of very high value. The following from Toronto, Canada, appeared in the *Gardener's Chronicle and Agricultural Gazette* of March 22, 1873, under the head of "Foreign Correspondence":—"The most vital point, however, of the beetroot grower is the quality of the seed he uses; when beets were first grown for sugar, 5 per cent. of sugar was the amount obtained, now 15 per cent. is obtainable in favourable instances. This has been attained entirely by the improvement of the pedigree principle of the seed. The quality of richness in the root was attained by Vilmorin in the following manner:—Each root is a perfect plant, and therefore, in the examination of each root for the production of seed, the quality of it had to be ascertained. For this purpose, Vilmorin had a set of most delicate instruments made for the determination of specific gravity, and he found that the specific gravity was indicative of the sugar contained. The cups he used were no larger than a lady's thimble, and the saccharometer or measure of specific gravity equally small. The roots were first selected according to the best ordinary rules, then a small portion of each root was punched out of it in such a part as to injure as little as possible its future growth; the pieces were reduced to pulp, and the juice was extracted. All the roots which did not yield juice up to a certain standard were rejected, whilst those which reached the standard were planted for seed; the roots produced from this seed *were found to be constantly increasing in richness*, and a few years of the process produced the great percentage of sugar which is now attained." I may here mention in reference to the foregoing that I had, so long ago as 1860, come to the conclusion that vigour of vegetable growth was identical with the power of supporting animal life, and that specific gravity was the measure of both. The difficulty of determining the specific gravity of a grain of wheat without impairing its vital vigour was, however, found insurmountable.

I will now refer to results obtained in cereals by selection, taking wheat as the illustration. The chief points to attain are vigour of growth, hardiness, productiveness, and quality, and these have become as permanent characteristics of the pedigree cereals as are the good points of a thoroughbred animal, and reproduce themselves as surely. I begin with a report from near Perth, Western Australia, in 1862, nineteen years ago. "The English wheat (Hallett's) sown before I came, produced when drilled 29 bushels per acre; and when dibbled, 35 bushels per acre. The average crops about here are under ten; ours were six; and our neighbours' opposite 4½ bushels per acre. The

[1] Paper read by Major Hallett at the Brighton Health Congress.