

the food remaining in the alimentary canal, first of all in a more or less solid form and of a dark colour, but after it has become fully enveloped in the cocoon the excrement comes away as a light-coloured liquid, the hue and consistency of which depend upon the amount of vegetable matter not previously evacuated and the amount of lime, carbon, and ammonia present. The respective proportions of these ingredients vary, I presume, with the food upon which the caterpillar has fed, and with the state of the atmosphere at the time of spinning; also the longer they remain coating the fibre the harsher and more discoloured it will be. It is therefore very necessary, I think, to remove this cement at a very early date; and this chemistry has shown the manufacturers how to do. Judicious feeding too may alter its nature. Before long, fresh cocoons will be at an early stage thoroughly cleansed from all discolouring matter, and Tasar silk will be available for manufacturing purposes as colourless as it is when first put forth by the caterpillar" (p. 21).

At any rate here is a fine field for both economic and philosophical results for both the chemist and the naturalist.

There are two crops of Tusser silk in the year, *i.e.* two generations of grubs pass from the egg to the imago, whereas the *Bombyx* of commerce so passes only once. The moth is considered a sacred insect, and it is interesting to read of the long series of ascetic ordinances connected with the attendance upon it, the failure to observe which will bring down the anger of the gods and destruction upon the cultivators. Yet the grubs are said to flourish better out-of-doors than under the roof and care of men, and are found feeding upon seventeen different species of trees growing wild over various parts of Hindostan. It is much more practicable and hopeful to engage the unenterprising natives in its collection under these conditions than if the elaborate art with which the Chinese cultivate the *Bombyx* were required.

The silk of the *Eria* and *Moonga* or *Muga* cocoons is softer and of a clearer colour than the Tusser silk, but lacks the strength of that very coarse variety. It dyes well, but is difficult to wind. In all respects therefore it is easier to work it up into spun silk.

The favourite food of the *Eria* is the *Palma Christi* or castor oil plant, *Ricinis communis*. So productive is this worm that it sometimes gives twelve broods, *i.e.* generations, in a year.

The *Muga* worm breeds five times; the colour of the silk varies with the food, some of it retaining its drabby colour till the last. The moths of all these genera are large and handsome. The magnificent *Attacus atlas* moth, called in France *Le Géant des Papillons*, measures upwards of ten inches in expanse of wing. It is a common idea that moths eat their way out of their cocoons, and that all permitted to do so spoil their silk; but even in the case of the solid cocoon of the Tusser moth it is observed that "after eight or nine months in the pupa state a moist spot is observed at one end of the cocoon. The moth is now about to emerge both from its pupa shell and from the cocoon. It secretes an acid fluid which softens the cement of the cocoon, and enables it to separate the fibres sufficiently to allow of its creeping out" (p. 19). Capt. Brooke also says that "in Seonee the pierced cocoons are wound, and that no koshtee rejects a cocoon simply because the moth has eaten its way through it. . . . It does not eat its way out but separates the fibres with its legs and wing-spine, and so creeps out. It has neither teeth nor mouth proper" (p. 26). More remarkable still is the provision made by the larva of this *Attacus atlas*, "the upper extremity of whose cocoon forms a natural orifice for the exit of the moth, made by the conveyance of a great number of silk fibres which are left ungunned, and are thus soft and flossy; thus the exit of the imago leaves no disturbance behind" (p. 63).

The most interesting question, of course, is, how far

care and industry can improve this imperfect natural wealth. The strongest proof of the value of such education is to be found in the fact that the beautiful Italian and French silks, whose fineness and regularity insure for them a price 50 per cent. higher than the best China silks, are the lineal descendants of the eggs brought from China in the reign of Justinian. The destruction caused among them by the dreadful disease, pebrine, has necessitated the import into Europe of Japanese eggs, the drabby colour of the silk of which marred all the efforts of the dyer to obtain clear delicate tints, especially in different shades of white; but careful attention and artificial selection are bringing them near to equality with the pure European silk; and Major Coussmaker in Pooneh has succeeded in obtaining perfectly white Tusser silk by causing the caterpillar to void all its excrement before spinning.

The special fitness of Tusser silk for the dark dull colours now fashionable is most optimistically expressed by Mr. Wardle in the phrase that "Tusser silk properly dyed inherently takes shades of artistic merit." Is dirt then beauty? and purity and brilliancy essentially vulgar?

There can be little doubt that European skill and machinery would more than balance the cheapness of Indian labour, which could be trusted to produce only the commonest qualities of thrown silk. It is also far safer and less likely to end in failure or discouragement to make spun silk the object of Indian produce than to attempt to rival the beautiful productions of Italy and China.

One cannot help noticing with satisfaction in this concise history the working together for good of such widely separated parties as, in India, the high Government official, the investigating naturalist, the active military officer in charge of a district; then the organising British manufacturer, who brings into willing co-operation the Italian throwster, the Leek dyer, the Halifax weaver, the London artist, not to mention the taste and skill of the lady-bountiful of her neighbourhood.

W. ODELL

NOTES

ON Tuesday evening, April 11, the public thoroughfare stretching between Hatton Garden and the Old Bailey was lighted for the first time by the electric light. The novelty of the installation was the fact that the incandescent system had been adopted in preference to the arc system. Mr. E. H. Johnson, the agent of the Edison Electric Light Company, has in fact made a public demonstration of the Edison system by lighting up a district of London in the same way as by gas. In addition to the street lights, the different premises lining the street are also lighted; for example, the City Temple Church, Messrs. Negretti and Zambra's, Messrs. Spiers and Pond's. In all there are 936 incandescent lamps, and these are fed by one of the large dynamos stationed at No. 57, Holborn, the distributing centre of the company. These large generators are made upon the same plan as the smaller ones recently described by us, and are driven by Porter engines. They yield a current of 1025 amperes. The resistance of each lamp white-hot is 140 ohms, and as this is much greater than the hot resistance of other incandescent lamps, the resistance of a long circuit is not so relatively high as in other systems, and hence there is less need of large leads. The cost of copper for conductors is an important item in electric lighting, but should copper conductors become too expensive to use, Mr. Edison intends to employ iron, say old iron rails. Mr. E. H. Johnson states that the company intend to manufacture and supply electricity for all kinds of purposes, and judging from experience gathered in New York, where a district is lighted by this system, the profits from the sale of electricity for power purposes alone will pay the company's dividends, so that they can afford to give the light for nothing. This remark is a rejoinder to those

who argue that the gas companies will successfully compete with the electric light, because the profits from their waste products will pay their dividends. The Holborn street lamps each contain two of Edison's bulbs suspended from a cross bar running through the top of the lantern. The light is of a golden tinge like gas, but much purer, brighter, and steadier. The lamps were switched on and off with the greatest ease, and altogether the experiment was a complete success.

THE Commission of the French Academy of Sciences for the Transit of Venus expeditions have completed their work. All the astronomers selected are practising daily at the observatory, taking readings with the artificial transit apparatus, invented by M. Wolf on the occasion of the last transit. In spite of some objections, which have been disregarded, three kinds of observations will be taken: (1) by direct contact; (2) by refracting prisms and micrometrical distances; (3) by photography. The stations are the following: French Antilles (Guadeloupe or Martinique), directed by M. Tisserand; Spanish Antilles (Cuba), M. d'Abadie; Florida (United States), Col. Perrier; Coast of Mexico, M. Bouquet de la Grye; Patagonia (on the Rio Negro), M. Perrotin, director of the Nice Observatory; (M. Bischoffsheim will be at the expense of the partial fitting out of this expedition); Santa Cruz, Capt. Fleuriais. It is to be remarked that very few of the heads of the missions sent out in 1874 have been appointed again by the French Institute. Four of these eight stations are located in the northern hemisphere, and four in the southern. At all of them will be observed the entrance and the exit.

THE use of Jablockhoff lights in the Avenue de l'Opera has been discontinued, the Municipal Council of Paris having refused to grant a concession of ten years, which was asked for by the Company. It is said that other electric light companies will make proposals for the illumination of that fashionable part of Paris. In the meantime M. Cances, the inventor of a new regulator, is illuminating experimentally the rue de Crassant, a long and narrow lane of Central Paris, where newsagents have congregated for the last half century.

ON March 20 last, William Edward Gaine, C.E., the inventor of parchment paper, died at the residence of his son, at Blackburn, at the age of sixty-five.

THE usual Congress of Astronomers and Meteorologists will take place this week in Paris, as well as the Congress of the Sociétés Savantes, the annual meeting of the Société de Physique, and the Association Scientifique de France. But the Congress of Instituteurs and Institutrices has been postponed for a future period. M. Ferry will deliver as usual the official speech as Minister of Public Instruction, on Saturday, on the occasion of the distribution of prizes to the delegates of learned societies.

MM. MIGNAN and RANARD have constructed an integrating hygrometer for precipitating the vapour of the atmosphere, and analysing the products if required. It is composed of an iron tube filled with liquor ammoniac; by gently opening a taper the ammonia is absorbed by water and the hygrometer is covered with moisture which is collected in a cup arranged for the purpose. During the recent dry weather the amount of precipitation was 3 grammes of water in twenty minutes. The weight of liquor ammoniac was 34 grammes. A peculiarity is that a number of floating particles are precipitated with the humidity of the air. It has been suggested by M. W. de Fonvielle that the hygrometer might be used for analysing the matter of clouds where the precipitation of a few grammes will be a question of a very few minutes.

EXPERIMENTING with electro-magnets on various minerals, Prof. Doelter has made the interesting observation that the absolute amount of iron present does not determine the degree

to which the minerals are attracted, for sulphides and sulphates containing much iron are very little attracted, while the attraction of oxides, carbonates, and silicates is strong. This varying amount of attraction (it is pointed out) may be of service in mechanical separation of natural mixtures of ores, purifying ores, isolation of rock matter, and approximate estimation of quantitative mineralogical composition.

THE project started by Admiral Mouchez of building a captive balloon for observing the conditions of the air at several hundred metres from the earth will be abandoned; but a captive balloon will be established at Montsouris Meteorological Observatory.

THE deaths are announced of Prince Wladislaus Lubomirski, an eminent conchologist, who recently died at Warsaw, aged fifty-eight; and of Prof. Vincenz Kletzinsky, Professor of Chemistry at the Wieden Communal School, who died at Vienna on March 18 last, aged fifty-six.

THE Ethnographical Congress which was to meet this week at Geneva has been indefinitely postponed. The number of participators who intended to be present from England, Germany, Austria, and Italy was not considered sufficient by the Committee.

MOUNT ETNA has again been in an active condition. An eruption and a rain of ashes (rampilli) has quite recently alarmed the neighbouring inhabitants.

THE first number is published of Dr. M. C. Cooke's "British Freshwater Algæ" (exclusive of Desmidiæ and Diatomaceæ). As no systematic work on the subject has been published since Hassall's in 1845, a good account of British Freshwater Algæ is much wanted. In the present number, which includes the Palmellaceæ only, Dr. Cooke has perhaps already reached the most difficult part of his work, the history of development of some of these lower organisms being still very obscure. We could have wished to see, at the outset, a greater effort to give the student something approaching a natural classification of Algæ, instead of the very rough and artificial one which Dr. Cooke has adopted. The exclusion of the desmids and diatoms is wise, these forming a separate literature of their own.

PROF. E. MORREN issues the ninth annual edition of the "Correspondance Botanique" (Liste des Jardins, des Chaires, des Musées, des Révues, et des Sociétés de Botanique du Monde), well posted up to the close of the year 1881.

IN addition to the above catalogue, the *Bulletin de la fédération des Sociétés d'Horticulture de Belgique* (1881), published under the authority of the Belgian Government, contains the official report of the National Exhibition of Horticulture and Pomology, held at Brussels in 1880, in honour of the fiftieth anniversary of the independence of Belgium; much other horticultural information, and a paper on the Bromeliaceæ of Brazil.

SINCE March 1 a new Spanish periodical, *Revista Germanica de Literatura, Artes y Ciencias*, is published at Leipzig twice a month. Its editors are Señores S. Gimenez and J. O. Monasterio; Herr L. Seidel the publisher. The object of the serial is to facilitate intellectual intercourse between Germany and the Spanish races.

AT the last meeting of the American Association a lecture was delivered by Capt. C. E. Dutton, of the United States Geological Survey, upon the "Excavation of the Grand Cañon of the Colorado River." The lecture was illustrated by a large number of lantern views. A picture of the chasm, at a point about the middle of its length, was exhibited as a type, showing that it consists of an inner and an outer gorge, or an upper and a lower chasm. The outer one is about five miles in width, with palisades on either side, very nearly 2000 feet high, facing each other across a comparatively smooth plain or valley floor.

Within this floor is sunken the great inner gorge, 3000 feet deep, with nearly vertical walls. The width of the inner gorge is about the same as the depth, or 3000 to 3500 feet. The strata exposed in this section are 4500 feet of Carboniferous (the entire local series), and 500 or 600 feet of Lower Silurian or Primordial. The speaker then indicated the salient features of the topography and stratigraphy of the country in the vicinity of the chasm. It is for the most part a desert plain, surfaced by the summit beds of the Carboniferous, with low mounds or flats consisting of remnants of the Permian, and occasionally a small remnant of the Lower Trias. Forty miles north of the chasm is found the main Permian mass lying as a higher bench or terrace terminated southwardly by a cliff. Proceeding northward, the Trias, the Jurassic, the Cretaceous, and the Lower Eocene systems are successively encountered, each at intervals of five to ten miles. Each of these formations is likewise terminated southwardly by a great cliff, and the whole series, from the Permian to the Eocene inclusive, constitute a stairway leading up to the high plateaux of Utah. Capt. Dutton stated that conclusive evidence has been found that these terraced formations, thus abruptly terminated, once extended southward across the Grand Cañon and far into Central Arizona, but have been denuded down to the summit of the Carboniferous. The total thickness of beds removed was a little over 10,000 feet, and the eroded area was from 13,000 to 15,000 square miles. This area is called by him the Grand Cañon district. The erosion began about the middle of Eocene time, and has continued uninterruptedly to the present. The cutting of the Grand Cañon is merely the closing episode of a much greater work. The excavation of the present cañon is a comparatively recent geological event, and Capt. Dutton is of the opinion that its origin does not antedate the Pliocene period. He then explained some of the more important considerations and conditions upon which the cutting of cañons depends, and showed the natural mechanical process of creating and maintaining the singularly beautiful and architectural profiles of the cliffs, and how their wonderfully constant outlines are preserved. He then entertained his audience by a graphic and enthusiastic description of the phenomenal scenery revealed in the wider and deeper portions of the chasm.

THE geology of Spain being yet very imperfectly known, we are glad to find in a recent number of the *Boletín* of the Geographical Society of Madrid the continuation of Don Juan Vilanova's paper on the geological survey of the province of Valencia, being a description of the Tertiary formation of the province. This formation consists of conglomerates and clays covered with marls, sandstones, grits, and gypsum, with beds of lignite and peat. The surface is undulated, forming low hills with gentle slopes, but intersected with deep ravines, or barrancos, or terrace-like, with deep ravines, along which streams flow in cascades during the rainy season. Wide lacustrine basins at Bicorn, which were considered by Verneuil as Cretaceous, belong also to this formation.

THE Jubilee Meeting of the British Medical Association will be held at Worcester, on August 8-11. The president-elect is Dr. William Strange, senior physician to the General Infirmary, Worcester.

PROF. HÆCKEL is giving some account of his recent visit to Ceylon and India in the *Deutsche Rundschau*.

WE read in the "Diario de Manila" that a German ethnologist, Dr. Schadenberg, of Breslau, has now resided for some time amid the savage tribes in Sibotam, at the foot of the Volcano of Apo, for the purpose of studying the ethnography of the tribes of Atas, Bagobos, Manobos, Mandayas, Tagacaolos, Vilanes, Samales, Sanguiles, Moros, and Guiangas. All these races differ materially in language, religious customs, attire, and habits, so that Dr. Schadenberg has certainly selected a rich field of study.

In a brochure published by Messrs. Sampson Low and Co., Col. Burnaby has given an interesting narrative of his recent balloon trip across the Channel.

THE additions to the Zoological Society's Gardens during the past week include a Black-eared Marmoset (*Hapale fenicillata*) from South-East Brazil, presented by Mrs. Davidson; a Ring-tailed Lemur (*Lemur catta* ♂) from Madagascar, presented by Dr. J. Lea, M.R.C.S.; two Grey-backed White-eyes (*Zosterops dorsalis*) from Australia, presented by Mr. J. Abrahams; a Jardine's Parrot (*Paeocephalus gularis*) from West Africa, presented by Capt. H. Hope Keighley, 2nd W.I. Regt.; three Zebra Waxbills (*Estrela subflava*), a Shining Weaver Bird (*Hypochera nitens*) from Africa, two Amaduvade Finches (*Estrela amandava*) from India, a Crimson-eared Waxbill (*Estrela phenicotis*) from West Africa, presented by Mrs. Beauclerk; a Common Buzzard (*Buteo vulgaris*), British, presented by Mr. J. C. S. Locke; a Common Partridge (*Perdix cinerea* ♂), British, presented by Mr. H. T. Bowes; a Long-tailed Copsychus (*Copsychus saularis*) from India, deposited; a Manchurian Crossoptilon (*Crossoptilon manchuricum* ♂) from North China, two Japanese Pheasants (*Phasianus versicolor* ♂ ♀) from Japan, an Amherst Pheasant (*Thaumalea amherstiae* ♀), a Gold Pheasant (*Thaumalea picta* ♀) from China, a Lineated Pheasant (*Euplocamus lineatus* ♂) from Tenasserim, two Black-backed Kaleeges (*Euplocamus melanotus* ♂ ♀) from Sikkim, two White-crested Kaleeges (*Euplocamus albo-cristatus* ♂ ♀) from North-West Himalayas, two Hasting's Horned Tragopans (*Cerionis hastingsii* ♂ ♀) from North India, purchased; a Rifle Bird (*Philorhis paradisea* ♂) from Australia, received on approval; a Sambur Deer (*Cervus aristoteles* ♀), a Gaimard's Rat Kangaroo (*Hyposiprymnus gaimardi*), born in the Gardens.

OUR ASTRONOMICAL COLUMN

A SYSTEMATIC SEARCH FOR COMETS.—The necessity of a more rigorous and systematic examination of the heavens with the view to the early discovery of telescopic comets has been somewhat forcibly exemplified of late years, and it is satisfactory to learn that American observers are taking the initiative vigorously in this direction. A partial arrangement for regular sweeping has been made, and is detailed in a circular issued from the office of the *Science Observer*, in which also further cooperation is invited, and it is to be hoped that amateurs here with the necessary instruments, and time at command, will actively second the efforts that are being made in the United States, to further our knowledge of these, as yet, in a cosmical sense at least, problematical bodies. Mr. W. F. Denning, of Bristol, after proving his extraordinary patience and perseverance in the observation of meteors, and who has done excellent work in that class of observation, has for some months instituted a search for comets in such quarters of the sky as his position best commanded, and has made, as we know, a most notable beginning by the detection of the comet of short period, which astronomers will recognise in future as "Denning's comet." He has kindly afforded us an opportunity of perusing a letter addressed to him by Mr. J. Ritchie, jun., of Boston, U.S., from which we may be pardoned for making the following extract:—"We wish it understood that although from the circumstances of the organisation, the majority of observers are here in this country, still we do not wish to make anything exclusive or national about it, and are simply after the most scientific ways of doing certain things, and are ready to receive that advice which the experience of others renders them competent to give." Mr. Denning has found a coadjutor to divide with him the examination of the eastern sky in the morning hours, and there should be little difficulty in arranging for other amateurs here to take part in an evening search. Two or more observers in the other hemisphere will be needed to complete the regular scrutiny of the whole sky, and we do not anticipate that the scheme will be rendered imperfect for want of them.

It would be an easy matter to cite a number of cases where the earlier detection of comets would have materially aided our knowledge of their motions in space, and probably of their gradual development in approaching the sun. We may refer to