THURSDAY, JULY 16, 1874

SCIENCE IN THE SHOWYARD

IT is difficult to over-estimate the benefits which practical agriculture has derived from the great country meetings of our Agricultural Societies. Shifting from year to year to different parts of England these annual exhibitions have brought the general progress of agriculture to bear in a direct manner upon local practice, and made the country farmer acquainted with the improvements that have originated in distant centres of activity; while at the same time the peculiar excellences of the district visited are prominently brought to light, and give their own distinctive character and teaching to the exhibition. The beneficial influence of such Agricultural Shows is much increased when, as in the case of the show now being held at Bedford, they are conducted by a first-class Society. Not only are the exhibitions in this case of greater number, and superior quality, but the character of the judging is superior also, and science is really brought to bear in awarding the prizes in the various classes. To refer to the present show of the Royal Agricultural Society at Bedford, the official lists tell us of the vast number of agricultural implements entered for competition, the class of drills alone including 135 entries. Every one of these implements, before this article is in type, will have been carefully tested by actual work in the field; the quantity of power required to produce a certain amount of work will have been ascertained by a dynamometer contrived expressly for the purpose; the construction of each implement will have been thoroughly criticised; and finally, its merits in each department of its work will have been expressed by an elaborate system of marking. The reports of these trials will in due course appear in the Society's Journal, and the farmer will obtain a valuable mass of information on the subject of implements such as no private individual could have given him. Anyone who desires to see how thoroughly the work of judging is done, and what wonderful skill is now brought to bear on the construction of agricultural machines, should read the two reports on Portable Steam-engines and on Ploughs and Harrows in the last volume of the Royal Agricultural Society's Journal. There can be no question of the immense benefit resulting to practical agriculture from such exhibitions, and from the publication of such reports.

Another chief item in Agricultural Shows, and perhaps the most attractive, is the live stock. The non-agricultural public has seldom any notion of the points aimed at by an intelligent breeder of stock, and those who have never attended one of the country meetings of our great Agricultural Societies may very likely expect to see a mere collection of fat beasts. Our agricultural readers well know that this is far from being the case. Bulk is by no means the object which the breeder has in view; his aim is the production of an animal perfect both in form and quality, and fitted in the highest degree for the various purposes which it is intended to serve. The same principle is also steadily kept in view by the judges, who are instructed by the Society to form their decisions entirely on the animal's character for breeding purposes, and not on its present fitness for the butcher. We need hardly say that our Agricultural Shows have had a large share in that wonderful improvement of our various breeds of stock which has taken place to such a marked extent in recent years.

The subject of the varieties and breeds of cattle is full of interest; indeed we hardly know a more instructive field for the naturalist's study than that presented by the showyards of our Agricultural Societies. Here he will meet with abundant and striking instances of what may be effected by artificial selection persistently carried on with a definite purpose in view; and here also he will meet with equal evidence of the great influence of climate and other ill-understood conditions, which put a limit to the possible work of the breeder, and confine certain varieties to certain districts. That so small a country as Britain should have so many distinct breeds of sheep and cattle localised in different parts of the island is certainly remarkable, and the subject becomes more interesting when we find that in many cases these local breeds cannot be maintained true to their character if transported to other parts of the island. Thus we have in Lincolnshire a breed of sheep remarkable for their long glossy wool. Many attempts have been made to establish flocks of these sheep in other parts of England, but as far as we are aware the peculiar gloss of the wool has always disappeared after a few years.

The effect of external conditions on the character of an animal becomes still more apparent if, after making acquaintance with British sheep and cattle, the naturalist crosses the sea and pays a visit to a continental agricultural show. The British farmer who visited the Vienna Exhibition last year must have stared with wonder at the collection of animals there displayed. He would probably regard with contempt the long-legged, woolly pig, with large and powerful snout, quite unlike the inhabitants of his own styes; but when he learnt that the Transylvanian pig spends its life in the forest, and in winter time has to grub for its food through a foot or more of snow, the British visitor would begin to perceive that the animal is really far better fitted for such a life than his own favourite "Berkshire;" and he would be prepared to hear that English pigs in such districts have proved a failure. Equally remarkable to an Englishman would appear the curious Merino sheep, bred entirely with a view to wool, but worthless considered as mutton, and the fine Hungarian draught oxen, admirably fitted for hard work and hard living, but which no amount of cake would turn into beef at two years old. These would be striking examples of the effect of artificial selection and natural conditions in producing different kinds of excellence from those aimed at in our own country.

In our autumnal shows the naturalist's attention might be directed with equal advantage to the influence of cultivation on the characters of the various seeds and roots exhibited. It is not so very long ago that the first Swede and the first mangold were introduced into this country; the varieties are now endless, and there is probably now quite as much difference between the roots originally imported and their modern representatives as between the greyhound-like swine one sees in old engravings and the present English examples of the race. Artificial selection has, in the case of roots and seeds, taken a wide scope, endeavouring to supply the very various wants of

the farmer. Varieties suitable for early and late growth, and for various descriptions of soil and climate, are aimed at, and in many instances produced. The advantage of having a continual supply of *new* varieties appears in some cases to be considerable ; thus in the case of the potato disease it seems generally acknowledged that a recently introduced kind resists disease far better than an old sort. Varieties cannot, however, as is well known, be trusted to maintain their character ; fresh seed must constantly be employed, and the process of selection must continually be maintained. The trade of the seedsman is thus one of never-ending use and importance. Perhaps one of the most striking recent instances of what may be effected by cultivation with a definite object is afforded by the case of sugar-beet. Beetroot contains somewhere about 8 per cent. of sugar ; cultivation, however, and suitable manuring have so increased this percentage that sugar-beet now yields 12-14 per cent. of sugar in the average of seasons, and in favourable seasons 17 per cent. is sometimes reached. We need hardly point out that the practical influence of Agricultural Shows is again most useful in bringing under the farmer's notice both the new varieties raised in this country and the new species introduced from time to time abroad.

The Royal Agricultural Society has lately gone a step beyond the usual limits of the showyard, and has taken advantage of its country meetings to offer prizes for the best-managed farm in the surrounding district. This is undoubtedly a step in the right direction. Hitherto the teaching of the Agricultural Show has been pretty much confined to the subjects of live stock and implements. Certain portions of the farmer's work have been exhaustively illustrated ; but farming as a whole has scarcely been dealt with. Might we suggest that the Royal Agricultural Society should go still further in carrying out its admirable motto, "Practice with Science," and endeavour to make its country meetings yet more effective in diffusing true knowledge. Why should not the Society arrange for two or three public lectures in the show-week, to be given by persons eminent in science or in practical agriculture? How much valuable teaching might thus be imparted. The Royal Agricultural Society has already exerted itself in the cause of scientific education for the sons of farmers, and has continued this work in the face of considerable opposition ; let it enlarge its good work still further, and aim at teaching the farmers who are annually gathered at its Agricultural Shows.

COLONIAL GEOLOGICAL SURVEYS

II.—VICTORIA

Geological Survey of Victoria—Report of Progress. By R. Brough Smyth. (Melbourne, 1874.)

MR. SMYTH must be a shrewd and clever person. He has one of the most difficult tasks to perform—to persuade or cajole a Colonial Government or Assembly which knows nothing and cares still less about anything scientific, to vote money for a scientific object and to take some interest in having that object carried out. Not many years ago Victoria had a regular Geological Survey, equipped at the colony's expense and directed by Mr. Selwyn, who now so ably conducts the great Survey of Canada. For some reason which we have heard variously described, but which seems to have lain to some extent at least in official jealousies and in differences of opinion as to the degree in which geological research as opposed to mere mineral prospecting should guide the progress of work, the Victorian Survey came to an end and its officers were left to seek employment elsewhere. At the same time the Department of Mines in the colony showed great activity in collecting mining and geological information, the prime mover in this being the secretary, Mr. Brough Smyth. When the Geological Survey ceased to exist he seems to have thrown himself more into a geological line. With no little sagacity and tact he gradually organised a less ambitious scheme for having the country geologically surveyed. He obtained the services of one or two members of the previous Geological Survey, and, with a small grant from the legislature, began to make a geological examination of some of the mining districts, and to prepare maps and sections to show their structure. Under the wing of the Mining Department he evidently could do a good deal without placing a formal vote for a Geological Survey service on the colonial estimates.

How much soever a man may have science at heart, in such a population as that of Victoria he can hardly hope to find much encouragement for science pure and simple. It is needful for him to show some practical utility in his work before he can expect to receive aid, especially of a pecuniary kind. Fortunately in Victoria one great element in the national wealth lies in mining. Anything therefore which tends to increase the value of mines, or to lead to the discovery of fresh mineral fields, appeals at once to the feelings of the colonial legislators.

Mr. Smyth indeed in the present Report grows very bold, going even so far as to assert that the main object of the survey should be scientific discovery, any practical benefit arising from the work being a sort of secondary and accidental circumstance. He takes good care, however, to bring the practical benefits well into the foreground, so that we imagine his superiors are not likely to quarrel with his theory so long as he adheres to his present practice. It would, indeed, be very short-sighted policy to interfere with him. He is unquestionably right in endeavouring to place the knowledge of the mineral structure of the colony on a sound basis of scientific exploration. There may perhaps be no apparent pecuniary return for the outlay at first, but the money expended as he is expending it will assuredly in the end be repaid tenfold. It will save a vast amount of expense in enabling colonists to decide where to begin their mineral ventures and in pointing out where no possible outlay could be profitable. It will stimulate the development of the mineral wealth of the country, and thus add directly and largely to the national prosperity.

We do not notice much of geological novelty in this Report of Progress, though some of the details are interesting, particularly in regard to fresh illustrations of the wonderful volcanic history of some of the goldfields, and to certain of the fossils which have been obtained in recent explorations. A list of all the fossil species hitherto obtained in the colony is inserted in the Report, and forms, so far as we know, the first list of the kind which Victoria has furnished. A considerable proportion of the species is from Upper or Lower Silurian rocks. A few are Devonian and Upper Palæozoic. With regard to Secondary and Tertiary rocks, Mr. Smyth very properly

avoids identifying his formations with those of Europe, and contents himself with indicating such indefinite horizons as Lower and Upper Mesozoic. The list of publications on the mines and geological structure of Victoria is already a tolerably long one, and indicates no small amount of activity. It includes Mr. Smyth's work on the "Goldfields of Victoria," which we favourably noticed at the time of its appearance.

Easy-going geologists in this country, who spend their winters comfortably in town, and can at any moment transport themselves by train or steamer to even the farthest parts of the kingdom, have little notion what geologising is in an unexplored region like that of so vast a portion of Australia. Mr. Smyth, for instance, in the most matter-of-fact way refers to one part of geological work in Victoria as "cutting tracks," that is, levelling the trees and scrub in a densely-timbered region so as to make a roadway into the wilds. He truly adds that every mile of such road-cutting is a gain of so much territory to the colony. We find that during three months of last year the survey spent 172*l.* 16*s.* 6*d.* in cutting tracks, each of which was of course a geological section.

But while all this work is going on in his own colony, Mr. Smyth's energies extend over the whole of his continent. At his suggestion, representations have been made to the authorities of the other Australian colonies, to aid in the preparation of a general geological map embracing the whole of Australia and Tasmania. This proposal having been favourably received, considerable progress has been made in the preparation of the map. Mr. Smyth remarks however, that no response has been received from New South Wales, which still remains a blank on his map. No explanation is given of this not very intelligible statement. Certainly there is abundance of information to be had regarding the geological structure of that colony, where, among others, the veteran W. B. Clarke has laboured so long and so well.

As an illustration of the thoroughness with which the Department of Mines endeavours to do its work, it may be mentioned that specimens of rocks or minerals which may be sent up from any part of the country are examined, and if need be analysed, a boon which appears to be taken advantage of to a considerable extent. Appended to Mr. Smyth's Report of Progress is an excellent Report on the Mineral Resources of Ballarat, by R. A. F. Murray, who we believe was one of Mr. Selwyn's staff. The appendix contains also reports on some of the colonial coalfields. In conclusion, it should be added, that this Report is admirably, indeed almost luxuriously, printed and illustrated, presenting a very striking contrast to the blue-books we are accustomed to at home. Mr. Smyth deserves great credit for the way in which he has organised his work, and we trust that a long series of excellent reports may be obtained from him. ARCH. GEIKIE

THE FISHERIES OF NEW ENGLAND

Report on the Condition of the Sea Fisheries of the South Coast of New England in 1871 *and* 1872. By Spencer F. Baird, Commissioner. (Washington: Government Printing Office, 1873.)

WHILE the question of the supply of fish to the English markets is being year by year more anxiously discussed, and measures taken for the restoration of those fisheries which have been decimated, and for the protection of those whose productiveness is threatened by overfishing, our Transatlantic brethren are engaged in the investigation of a similar question in connection with the produce of their own waters. The wonderful fertility of fish, and the apparently inexhaustible supplies to be found in the waters of all parts of the world, have given rise to the idea that there is no limit to their abundance, and that no appreciable diminution in their numbers can be effected by the most unrestricted fishing. The experience afforded by the example of the salmon fisheries of this country has shown the fallacy of this idea. The most productive rivers have been reduced to absolute unproductiveness, and the most stringent measures have been adopted for encouraging the growth and restricting the destruction of fish. Overfishing, it is found, is not only possible, but has a very speedy effect on the natural supplies; and already the people on the other side of the Atlantic are experiencing the truth of this fact. Notwithstanding the enormous seaboard possessed by the United States, it is found that the supplies of fish are no longer equal to the demand, and the most important fish-producing States have consequently instituted inquiries with the view of adopting remedial measures. Opinions on no subject are more varied and contradictory than on the question of fish supplies. This is inevitable, as comparatively little is known of the habits of fish, and persons are too apt to generalise upon the result of their own limited experience. Finding the testimony of various authorities too conflicting to be of any use, the State of New England appointed Prof. Baird, of the Smithsonian Institution, to make a detailed inquiry into the condition of the fisheries on the coast and lakes of the country generally. The present report is the result of his first year's operations.

Anyone conversant with the fisheries of this country cannot fail to be struck with the similarity that exists between their condition and that of the American fisheries. The river fisheries of England had long been falling into decay, and were almost annihilated, when measures were adopted for their restoration. The river fisheries of America have also fallen off in productiveness, the only astonishing feature being the suddenness of this decay. There are many causes, such as the existence of pollutions, of obstructions, and of navigation, that have militated against the fisheries of this country which have not had equal force in America; but the principal cause of decay has acted more speedily there, and it is apparent that overfishing, and the destruction of spawning fish, have been on both sides of the Atlantic the chief enemy to the continued prosperity of river fisheries. Here salmon, there bass, have been trapped both in their upward and downward progress in the rivers, and no "close season" has been allowed in which they might, unmolested, perform their natural functions of reproduction. In England "fixed engines," *i.e.* devices fixed in the run of the fish, and intercepting almost every individual that would attempt to pass them, have been abolished. In America these instruments are more largely used than ever they were here; and a glance at the diagrams presented by Mr. Baird shows their terribly destructive nature. In some rivers, and on some parts of the coast, they are placed so thickly that no fish can pass

them; and, as they are *in situ* all the year round without intermission, it is no wonder that the fisheries are decreasing in value. The total abolition of these engines is suggested as the only real remedy. But the Commissioner is afraid that such a regulation would entail great loss on the owners of such instruments, and would also suddenly interfere with the supply of fish to the public. These traps can fish without human help, while the more legitimate fishermen's nets and gear can only be employed in suitable weather. He recommends that an interval of sixty hours every week should be enforced, during which the use of traps and pounds should be absolutely interdicted; that an annual close time of fifty-six days, viz. from April 20 to June 15, should be established, during which the use of such engines should be prohibited; and that the licensing system adopted in England should be introduced.

This is certainly a step in the right direction, but we venture to think that a diminution in the number of fixed engines would be advisable, and that such diminution should be partially enforced at once, and be gradually continued till the whole of these instruments are abolished. This need entail very little hardship on individuals, and would certainly not interfere with the regular supply of fish to the markets, while the eventual increase would more than justify the enactment.

In regard to the more purely sea fisheries, the similarity between the British and American fisheries is equally striking, while at the same time the rapidity with which the produce of American waters has fallen off is still more marked. On the English coasts the fisheries are continually fluctuating, but in no part does the diminution in the capture appear to have been so great and so permanent as it is recorded to be in America. The curious extracts from works of two hundred years ago testify to the great natural abundance of fish in the seas adjoining to the American shores; and, to come to more recent years, the printed evidence of living fishermen clearly shows that, for some reason or another, the sea fisheries, like the river fisheries, are much less valuable than they were thirty years ago.

The principal fishes of the coast to which the volume more particularly refers are the "blue fish" (*Pomatomus saltatrix*), also called "horse-mackerel;" the "scup" (*Pagrus* or *Stenotomus argyrops*), "squeteague" (*Cynoscion regalis*), a species of bream; "menhaden" (*Brevoortia menhaden*), a species of herring; sea bass and striped bass (*Roccus* or *Labrax lineatus*); mackerel (*Scomber scombrus*), similar to the common European mackerel; "tautog" or black fish (*Tautoga americana*), of the *Labridæ*, or wrasse family; herring (*Clupea harengus*), and cod, both of the well-known species. Of these, the principal diminution has been found to have occurred among the blue fish, the bass, the scup, and the tautog. The former of these is a very voracious fish, rivalling the shark in its powers of destruction, so much so that to its agency has been ascribed the diminution of other kinds of fish in localities where it is generally caught. But since it has itself greatly diminished, it is hardly possible that the decrease of other fish is attributable in any degree to the depredations of one predaceous kind.

Besides the above there are many other kinds of fish, more or less valuable as food, and sought after also on account of the oil they yield, and for the purposes of utilising them as manure, a complete list of which is given by Prof. Baird. This list is most valuable as condensing and correcting the various imperfect catalogues that have from time to time been made, and as exemplifying the natural richness and fertility of the seas on the seaboard of the Eastern States. As an instance of the extreme difficulty of accounting accurately for the increase and diminution in the capture of fish, we may quote the unexpected appearance of a species of Tunny, a kind of small horse-mackerel (*Orcynus thunnina*), which, though never previously recorded as having been caught on the American coast, was found in great abundance in Menemsha Bight by the Commissioner. The movements of fish are far more difficult to watch and to account for than those of land-animals, and great difficulty is experienced in following them. On some occasions a certain kind of fish has been very abundant in one locality, while a short distance away it has been very scarce; and one fishing-ground has been deserted one year, to be visited by large numbers the next year. One fallacy concerning the movements of the American migratory fish seems quite exploded. To quote Prof. Baird:—

"It was formerly supposed that certain fish, as the herring, the shad, and the alewives, with others of like habits, prosecuted an extensive migration along the shores of the ocean, covering, sometimes, thousands of miles in the sweep of their travels; and much eloquent writing has been expended by such authors as Pennant and others in defining the starting-point and terminus, as well as the intermediate stages of the voyage. The shad, too, which, as is well known, occupies all the rivers of the Atlantic coast from Florida to the Gulf of St. Lawrence, was thought to begin its course in the West Indies, and in an immense body, which, going northward, sent a detachment to occupy each fresh-water stream as it was reached, the last remnant of the band finally passing up the St. Lawrence, and there closing the course. We now, however, have much reason to think that in the case of the herring, the shad, the alewife, and the salmon, the journey is simply from the mouths of the rivers by the nearest deep gully or trough to the outer sea, and that the appearance of the fish in the mouths of the rivers along the coast at successive intervals, from early spring in the south to near midsummer in the north, is simply due to their taking up their line of march, at successive epochs, from the open sea to the river they had left during a previous season, induced by the stimulus of a definite temperature, which, of course, would be successively attained at later and later dates as the distance northward increased."

It seems pretty well established that, with the American migratory fish, which enter fresh water to spawn, as with the English salmon, the same individuals pass as nearly as possible to the same river, or at least to the same locality, and the same rule applies to their progeny—the young fry appearing to return to the river in which they were hatched.

Of these migratory fish the salmon has been well nigh exterminated, and the shad alone appears to keep up its numbers. Whether or not this is altogether owing to the exertions of the fish culturists, who have hatched artificially many millions of these fish and turned them into the various rivers, it would be rash to say positively; but no doubt this means, and the erection of suitable fish-passes to enable the fish to surmount the weirs, have had a large part in effecting this result.

As regards the practical protection of fisheries, whether in sea or river, the case of the Americans is almost identical with our own; and the remedies to be adopted must be the same in both countries. As regards the scientific side of the question, relative to the habits and distribution of fish, there is much that is new and valuable in the Commissioner's report. Indeed, the greater share of the volume is devoted to such questions, and to the scientific classification, not only of fish proper, but of the various other forms of life found in the waters, and important as either providing food for the useful fishes or as preying upon them.

The various invertebrate animals which form the principal diet of fishes appear to exist in profusion, so that the scarcity of food-fishes cannot be attributed to the want of natural sustenance. Some of these animals which serve as a prey to fish when young, in their turn become aggressors when full grown. An interesting account is given of the destruction caused by various kinds of *Cephalopoda*, which commit great havoc amongst the schools of mackerel and herring. In attacking the mackerel "they would suddenly dart backward among the fish with the velocity of an arrow, and as suddenly turn obliquely to the right or left and seize a fish, which was almost instantly killed by a bite in the back of the neck with the sharp beaks;" and yet these same "squids," when young, themselves afford abundant and favourite food to fish.

The subject of sea-bottom is nowhere of such importance as where oysters exist, and Prof. Baird's researches on this point are most valuable. His remarks, which we have not space to quote in full, might be studied with advantage by those who are interested in oyster culture in England and in France.

Nearly 300 carefully executed engravings of the rare and more valuable forms of invertebrata conclude a volume of which but a faint outline has been given.

BALDWIN'S "IRISH FARMING"

Introduction to Irish Farming. By Thomas Baldwin, M.R.I.A., Superintendent of the Agricultural Department of National Education in Ireland, &c. (London: Macmillan & Co., 1874.)

IT is only by the spread of thorough technical education among our farmers that the most will ever be made of the comparatively small area which in these islands can be devoted to agricultural purposes; only by a scientific knowledge of the material with which he deals will the farmer be enabled to improve to the utmost the quantity and quality both of his crops and live stock. By careful selection and suitable feeding vast improvements have within recent years been made in the quality of the latter commodity, and by a scientific study of the various kinds of crops, of soils, and of manures, natural and artificial, rapid progress is being made in forcing "the earth to yield her increase" in greater and greater quantity and of richer and richer quality. No doubt as the reign of science becomes more and more universal, farming, like all other human pursuits, will be followed with more and more of skill founded on accurate scientific knowledge, and will become gradually less a matter of blind rule-of-thumb. In many instances this is the case in Great Britain and in Ireland even now, many of our farmers bringing to bear upon their pursuit a knowledge of the results of the most extensive and exact scientific investigation. It will be long before such an intelligent knowledge becomes universal, we fear; and meantime such manuals as Mr. Baldwin's are of use in spreading among farmers, large and small, who have had no technical training in their occupation, a knowledge, conveyed in popular language, of what can be attained by scientific or skilled farming.

The work comprehends much in comparatively small compass. It treats first of manures, and the necessity of their application to supply the waste in the land caused by cropping. Without going deeply into the chemical properties of soils and manures, it affords plain directions which the unscientific man can clearly understand and appreciate; and considering the general character of the large class which the author essays to enlighten, he has taken the most efficient method for attaining his purpose. His remarks on farmyard manure are just, but he might have expressed his preference for covered yards more strongly, as, besides other advantages, these preserve the manure from rain-water; and, where fodder is in plenty, the liquid is absorbed and utilised in a way which it cannot be to equal advantage when applied by itself. It is well ascertained that dung made in such yards is much richer than in ordinary yards, as from being gradually compressed by the treading of the cattle the ammonia cannot escape, nor any appreciable waste occur. The author's estimate of the quantity of the manure made from one cow in the year at twelve tons is certainly too great if quality as well as quantity is desired.

The second chapter is devoted to the culture and management of green crops and cereals, including potatoes, carrots, turnips, mangold, &c., and the ordinary corn crops. Specific directions are given as to what kinds to sow on particular soils, and how to manage them in the fields and in storing them, each variety being specially referred to in its comparative productiveness and utility. The author's remarks on hay-making are well worthy of perusal. There is no crop so mismanaged as this, especially in Scotland, and considering its extent and value, no censure can be too strong on the negligence and want of skill so generally manifested in securing it.

The third chapter is devoted to live stock, and here the author seems to have studied the various phases of breeding and fattening with a practical eye. Ireland is peculiarly well fitted for rearing stock, and the yearly supply it affords to Great Britain is marvellous. With a moist climate and an alluvial soil, the Irish farmers possess facilities in their fresh swards and luxuriant green crops which we do not possess on this side of the Channel; until at all events we go across the Tweed, and not even there in sufficient breadth and measure, for permanent grass meadows are seldom to be seen. The quality of the various breeds of cattle and sheep is discussed; but it must be remarked that a great complaint on this side of the Channel is made as to the want of quality and growth in much of the supply afforded us; this is no doubt owing principally to the careless selection of breeders, and to too much indiscriminate crossing. The author's remarks on poultry deserve special attention, not

that he says anything peculiarly novel, but he treats the subject so plainly and in so much detail, that practical use can be made of his directions on a hitherto too much neglected point in rural economy.

In Chap. IV. examples are given of successful farming, both in large and small holdings, which all interested would do well to peruse. With industry and skill based on scientific knowledge, the productive power of the soil is astonishing. We see this more especially in the arid and sandy ground in Belgium, where two or three acres produce is sufficient for the support of a family. Steam ploughing, no doubt, is an equivalent for spade husbandry in stirring and pulverising the soil, but the personal exertions and superintendence of the cottager in thorough tilling, in careful seeding, successive cropping, manuring, weeding, and harvesting, cannot be excelled or equalled in substantial production. There is, moreover, in Scotland at all events, a degree of comfort and healthy sturdy appearance among that class, now perhaps too limited in number, which bears a striking contrast to the beer-drinking artisan and his wan shrivelled children in towns.

The author concludes with a chapter on cottage-gardening, which may be profitably studied by those of more pretension than the mere cottager. In England the taste for decoration and utility in small gardening is much more manifest than in Scotland, where little else than Scotch kail and weeds are, as a rule, to be seen. Mr. Baldwin has, on the whole, done ample justice to the various subjects he has treated, while the scope of his work is sufficiently comprehensive for the guidance of those who need instruction ; and most farmers do, be their rural occupation of small or large compass.

We hope that the spread of works of this class will pave the way for the general circulation among farmers of works of a much more technical and scientific kind, and that ere very long, through the exertions of the Agricultural Societies, both of England and Scotland, Agricultural Schools will be established in convenient centres both in England, Scotland, and Ireland, by means of which the British farmer will be at least on as good a footing as the farmer on the Continent of Europe and in America.

OUR BOOK SHELF

Elementary Dynamics, with numerous Examples. By W. G. Willson, M.A. (Calcutta : Thacker, Spink, and Co.)

Principles of Mechanics. By T. M. Goodeve, M.A. (Longmans' Text-books of Science.)

THE first work on our list does not aim at a novel exposition of principles, though it differs from the ordinary text-books in use amongst junior students. Notes originally put together by the author for the use of pass students of the Calcutta University have, after some considerable trial of their merits, been put together in the present form so as to embrace all the parts of the subjects which are generally treated of in text-books.

Mr. Willson is an ardent admirer of the works by Professors Thomson and Tait ("the magnificent treatise on Natural Philosophy," "the reader who wishes for further information on this subject (and on all such subjects) is recommended to consult," &c.), and his principal aim has been, we expect, to render the views of these distinguished writers more accessible to junior students. Knowing how liable authors are to go to pieces on the kinematic rocks, we have gone as carefully as we could through the text, and it appears to us that the author not only understands his subject, but has manifested ability in presenting his material in a clear form to his readers. Dynamics he subdivides into statics and kinetics. In both these branches he adopts for unit of force the kinetic unit for which the pound avordupois is the unit of mass. We may remark in passing, that this is the only elementary book we know which goes fully and carefully into the subjects of the several units. Under the head of statics, the writer treats of force at a point, of parallel forces, of moments, of centre of gravity, resisting forces, machines, and of work and energy ; under the head of kinematics, we have velocity, accelerated velocity, and kinematical principles and methods ; under kinetics, we have dynamical laws and principles, the force of gravity (falling bodies, motion on an inclined plane, Attwood's machine, &c.), collision of bodies, and energy. On p. 130, the term *Roman* steelyard is derived from Rumán, an Arabic word for a pomegranate, "and the shape of the counterpoise seems to have given rise to the name." There are a great many examples, many very familiar to us, given at the end of the various chapters. The author apologises for imperfections in type and diagrams, but he need hardly have done so ; we have seen worse diagrams in text-books got out nearer home. Some typographical blunders we have detected, but the context will enable a reader to correct them. The work has no index, is of a handy size, and gives one a favourable impression of the sort of training provided for the Calcutta students.

Mr. Goodeve's name is sufficient warrant for the accuracy and thoroughness of any work on mechanics that bears it on its title-page. His style is very lucid, and the accuracy and fulness of his knowledge of his subject enable him to give just sufficient explanation and yet not be too concise. He aims at a different class of students than that we have had to consider in the former part of our notice. These Text-books are designed for the "self-instruction of working men," and the two works by our present author in this series seem to us just fitted for them. In the work before us we are taken over a wide field. In an Introduction of sixty pages we have a miniature treatise, the representation of force, the gravitation measure of force, the laws of motion, and the meaning of the term energy, *inter alia*, are discussed. In the remaining twelve chapters most of the ground gone over in the first-noticed work is gone over rapidly here, and copious application of the principles is furnished by the description of a number of machines, the bare enumeration of the names of which would furnish an ordinary "Bookshelf" notice ; in addition we have an account of the equilibrium and pressure of fluids and of gases, of the hydraulic press and hydraulic cranes, a chapter on girder beams and bridges, the strength of tubes and the catenary, all treated without reference (except in one or two places) to the calculus. We have much pleasure in commending this recent addition to the series, with its clear type and numerous and excellent diagrams, to all who take an interest in mechanical applications. There are many excellent exercises scattered throughout the work.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

The Degeneracy of Man

IN NATURE, vol. x. p. 147, Mr. Edward B. Tylor writes :—

"It would be well worth while if Dr. Peschel, from personal or published sources available to him, would settle once for all the question whether the great Bavarian ethnologist (Martius) continued through life the degenerationist that we in England suppose him to have been."

Now I can assure Mr. Tylor, from having often conversed with Dr. Martius on Brazilian topics, that his degeneration theory belonged to his earlier life, that afterwards he altered his opinions, and that the passage quoted by Mr. Tylor from Martius contained his latest conviction. Soon after the publication of his Ethnography he died at Munich. OSCAR PESCHEL

DR. MARTIUS found the rude natives of Brazil treating the hunting-ground of each tribe as common to all the tribesmen, but allowing each family to hold as its own freehold the ground which it had built huts on, or brought under tillage. It is not surprising that this ethnologist, comparing such a rudimentary form of the "village community" with its more artificial arrangements in ancient Europe, should have considered the Brazilian tribes to have arrived at an intermediate stage of the development of land-laws, above that of the lowest savages, and on the way to that of more civilised nations. Mr. Edkins, however, in his letter to NATURE, vol. x. p. 163, thinks that Dr. Martius should not have explained the origin of the Brazilian land-law in this obvious way. The suggestion which he offers in its place is, that inasmuch as the Chinese had in old times a highly artificial system of partitioning their village-lands among the heads of families, some of these Chinese are to be supposed to have emigrated to the Brazilian forests and introduced this system, which in course of ages decayed till nothing was left but the simple rule found by Dr. Martius. But is not the word "far-fetched" applicable to this argument? Sooner than allow the rude people of Brazil to have been human beings capable of adopting the simplest social regulation for their own evident benefit, Mr. Edkins sends half-way round the world for imaginary Chinese emigrants, to introduce, not the savage law itself, but a civilised law which, if broken down to its last remnant, might be reduced to the Brazilian level. And, one may go on to ask, where is it likely that the Chinese themselves got their law of village-lands, if it was not developed out of lower stages of the law of property, belonging to lower stages of civilisation? If Mr. Edkins would turn his great knowledge of Chinese matters to investigating the origin of Chinese institutions, I think he would contribute new evidence to the development-theory of culture. Mr. Edkins next brings forward the evidence of numerals in Polynesia as proof of degeneracy in civilisation. The fact that the word *mano* means 10,000 in the Tonga Islands, 4,000 in the Sandwich Islands, and 1,000 in New Zealand, he accounts for on the supposition that the highest number was the original meaning, but that it was lowered with a fall in civilisation. But he will, I think, on further examination be satisfied that the real reason has nothing to do with degeneration, but with the curious Polynesian habit of counting by twos, fours, and even tens. Thus *rau* and *mano*, which in New Zealand mean 100 and 1,000, come to mean in Hawaii so many fours, viz. 400 and 4,000; Mr. Edkins' own example from Ponape shows the same done with tens (see Hale's "Ethnography of Wilkes' Expedition"). Mr. Edkins also remarks that "the Polynesians formerly had a decimal arithmetic; now it has sunk in Australia to quaternary or quinary arithmetic." But the Australians are not of the same race as the Polynesians, nor is there the least reason to suppose that they were ever at a Polynesian level of culture. As the evidence of numerals has been introduced, it may be mentioned that both Australians and Polynesians use numerals derived from counting on the fingers. Thus the Polynesian *lima*, *i.e.* "hand," is the ordinary numeral for five, while the West Australian will say "the hand on either side and half the feet," meaning by this long expression the number 15 (see my "Primitive Culture," chap. 7). I may add that I have been trying for years to get any degenerationist to answer the argument from numerals of this very common class, which can only have arisen by development from the lower stage of counting on the fingers, and which therefore prove savage tribes to be capable of independent intellectual development.

The *Quarterly Review* argument from the recent discoveries of Dr. Schliemann in the ruins he considers to be of Troy, merely shows that low barbarians may build on the ruins of towns previously inhabited by more civilised nations. This often happens, and can hardly be held to prove that the higher civilisation existed in the world before the lower.

As to the observations (vol. x. p. 163) of Mr. Hyde Clarke on affinities which he believes to exist between languages of Brazil and of the Old World, I cannot make any answer, not having seen any comparative vocabularies on which such an opinion could be founded.

EDWARD B. TYLOR

Photographic Irradiation

FOR the purpose of determining whether any sensible amount of the photographic irradiation surrounding the image of a bright object could be traced to an action taking place within the thickness of the collodion film, I some time ago tried an experiment in many respects similar to that detailed by Mr. Aitken in your last number (vol. x. p. 185). A piece of cardboard with four parallel narrow openings, each some 12 in. long, was hung against the glass roof of a photographic studio so as to be projected against the background of a bright sky. One of the slits or openings was covered with a piece of red glass, another was glazed with blue glass, the third was left entirely uncovered, and the fourth was covered by a piece of thin tracing paper. The slits in the cardboard screen were carefully focused, and over-exposed photographs were taken with a camera in which no stops were used. Upon the collodion film and immediately in contact with it was laid a piece of platinum foil quite thick enough to be perfectly opaque. The camera was so placed that the images of the slits fell partly upon the platinum foil and partly upon the collodion film. I have now before me two of the plates, each taken with an exposure of five minutes. The first was coated in the ordinary manner with a single collodion film, but the other was coated three times successively with collodion, so that the film was rendered very thick; but the eating in or encroachment of the photographic images of the slits under the platinum foil is hardly perceptible in either plate; indeed, I feel that I cannot say with certainty whether there is any encroachment of the image proper, though there are very marked brush-like extensions from the ends of the images, as well as a cloudy semicircular field symmetrical with the end of each image, evidently arising from reflections from the back of the plate. At first sight the brush-like semi-opaque extensions might be taken for the ordinary photographic irradiation eating under the platinum foil; but on more closely examining the ends of the images, the hazy opacity is seen to extend farther in some directions than in others, and to be broken up in some cases into five or six little streams or brushes. The decrease in the opacity of the brushes is also less uniform than the decrease in the opacity of the ordinary irradiation border. The brushes extend to a distance of about ·02 in. under the edge of the platinum foil.

I do not at present see my way to devise an experiment which would determine what is the cause of these little brushes, nor have I at present had an opportunity of repeating a similar experiment with the dry-plate process; but the brushes have the appearance to me of having been produced by streams in the delicate film of liquid which must extend under the platinum, streams which probably carry with them little masses of light-altered silver, that are soon deposited or strained out in the spongy tissue of the collodion.

If the spreading action under the platinum foil were caused by light dispersed within the thickness of the collodion, one would expect such action to take place symmetrically around the place where the bright image is cut off instead of being broken up, as I have described, into bundles or brushes. On the other hand, slight differences in the texture of the collodion, or minute inequalities on the edge of the platinum foil, might cause the streams in the liquid film to move more easily at one point than at another.

I should be glad to be informed what was the distance of the opaque bar from the collodion plate in Mr. Aitken's experiments, and whether there is not any photographic trace of defraction bands, owing to the bar not having been in focus; possibly the presence of these may account for the apparent difference in our results. It will be seen that the experiment which I have described points to the same conclusion as that formerly announced by Lord Lindsay and myself, viz. that the inner photographic diffraction edge is chiefly due to the imperfection of the instrument producing the image, chief among which is to be counted the aberration of oblique pencils.

A. COWPER RANYARD

MR. AITKEN'S observations on photographic irradiation in NATURE, vol. x. p. 185, are confirmed by many experiments I have made. I spent a long time in efforts to get rid of irradiation in bromide of silver films, one of the results of which I stated in a former note to NATURE (vol. x. p. 63). There is the most striking difference in the behaviour of films containing iodide of silver only to those containing the bromide alone, the latter, especially when dry, giving much greater irradiation; and the difference is again complicated by the addition of certain substances (notably albumen) to the film in the course of preparation. As my experi-

ments were mainly with dry plates, I will leave out of question the forms which the phenomenon may assume in wet-plate photography, and summarise the results of hundreds of experiments with dry plates iodised, bromo-iodised, and bromised.

With a simply bromised film the amount of irradiation is extreme. The film is very translucent and the irradiation is of two kinds, that caused by reflection from the back of the plate being by far the most extensive, but remediable by the usual expedient of coating the back of the plate with red or black colour, while the form noticed by Mr. Aitken is perhaps partially inherent in bromised films, but to a much greater degree dependent on the nature of the pyroxyline. Two samples of pyroxyline made at different temperatures, and treated in precisely the same manner, differ so much, that while one will, with the coloured backing, give scarcely a perceptible degree of irradiation, the other will develop it to an extent which no backing, nor even tinting the film with the aniline reds, will obviate. The former is generally a compact, lustrous film, scarcely to be distinguished from the glass itself, while the other (both being used without preservative solution) will give a dull and dusty-looking surface, only capable of reflecting at very small angles. If with the latter a strip of blackened wood be laid on the film so as to cut across the lightest portions of the image thrown on it by the lens, the effect of the light will be found to spread behind the strip of wood, sometimes to the extent of a centimetre; but I have never noticed the sharp limitation of this form of irradiation which Mr. Aitken observes, and which probably depends on the wet state of the film. It is clearly, as he supposes, an agitation which is set up in the film, and which depends for its propagation amongst the surrounding molecules upon a kind of chemical transparency in the film holding the bromide of silver. That this is to a great extent true is shown by two experiments: (1) a film which, in its simple state, gives considerable halation, will, when coated with albumen, especially if coagulated with nitrate of silver, give none at all, or very little, though the ocular transparency is rather increased than diminished by the albumen; (2) an emulsion prepared by exposing it to the action of nitrate of silver until it becomes structurally decomposed, and highly charged with bromide of silver, shows absolutely no irradiation under any circumstances even if the glass be not backed, and no kind of preservative used. The film in this case resembles unbaked porcelain in its whiteness, entire want of lustre, and in opacity, and the molecules of bromide of silver are more than usually free from any restraining influence which a preservative might be expected, reasoning from the usual action of the albumen, to exert. In these two cases of extreme translucency and opacity of the film there is almost an equal freedom from the phenomenon in question.

In the old albumen process with translucent films the irradiation is imperceptible, and in the collodio-albumen, where the film of albumen is allowed to remain on the collodion, it is almost so; but in this case, as in all cases where the film is charged only with iodide of silver, there is another element which complicates the action. The bromide of silver is reduced *in situ* while the iodide requires a supply of silver from the developer from which to build up the image, in the one case the deposition being by reduction, in the other by accumulation. This alone would account for a wide difference in respect to irradiation, but will not account for all, as is proven by the diverse results obtained from different bromide films, due to the varying structure of the material which holds the bromide in place.

What Mr. Aitken calls "molecular irradiation" (and which is not by any means the harmless thing he considers it in regard to artistic photography any more than to scientific) is unquestionably the great enemy of all photographic precision. It seems, however, to be complicated with what I have been obliged to call structural irradiation, alluded to above, and depending, as I have said, on the mechanical rather than the chemical condition of the pyroxyline of which the bulk of the film consists. The subject yet demands much investigation, of a purely empirical character, in order to determine the quality of vehicle for carrying the sensitive salts, neither chemical analysis nor chemical analogy affording any indication of the true cause of the difference between the two qualities of pyroxylene I have noted, nor do they, so far as I am aware, account for the difference between the action of collodion and albumen.

W. J. STILLMAN

Altenburgh Gardens,
Clapham Common, S.W., July 13

*OBSERVATORIES IN THE UNITED STATES**

II.

LIEUT. M. F. MAURY was placed in charge of the new U.S. Naval Observatory, and entered on his duties with zealous purposes. He proposed in 1846 the immense astronomical work of a more extensive and precise cataloguing of the stars than Bessel's "Zone Observations" or Struve's "Dorpat Catalogue." Valuable results of the scheme, so far as it could be entered on, by the observations of Profs. Coffin, Walker, Yarnall, Hubbard, Keith, Major, and Ferguson, and Lieutenants Almy, Maynard, Muse, and others, have been lately reduced and published.

Two events marked this early part of the history with still more importance. Walker, in 1846, proved that the new planet Neptune, just then discovered by Leverrier, had been catalogued as a star by Lalande in his "Histoire celeste" in 1793; and Walker, with Lieutenants Almy and Gilliss, was the very first to use, in 1846, the new discovery of the telegraph to determine differences of longitude. The identification of Neptune with Lalande's star gave astronomers, in determining the new planet's orbit, the use of observations made fifty-two years before. It gave the *American Nautical Almanac* two years earlier ephemerides for the mariner. It brought the observatory into prominence. The superintendency of Maury extended from 1845 to April 26, 1861, when he suddenly left the city to join the cause of the South.

In 1861 Lieut. J. M. Gilliss was at length placed in charge. He re-established and vigorously pressed forward astronomical work as well as the duties of the "Hydrographical Office," a title which had been added to that of the Naval Observatory. After his very sudden death, his successor, Rear-Admiral C. H. Davis, carried forward the astronomical work with that eminent success which had been guaranteed by his previous astronomical tastes and occupancy on the Coast Survey and as superintendent of the *Nautical Almanac*. Rear-Admiral B. F. Sands, succeeding him in the year 1867, has most efficiently improved the opportunities of a longer superintendency to inaugurate and carry forward some of the most important astronomical operations of the day. The phenomena of the total eclipses of 1869 in the United States and of 1870 in the Mediterranean countries were closely observed.

Beyond the regular and severely exacting astronomical routine of observations, two centres of interest have been recently occupying the utmost activities of the institution; the reception, mounting, and use of the new great equatorial, and preparations for the transit of Venus.

The great equatorial has but one near approach to itself in the diameter of its object-glass—that of the private establishment of Mr. R. S. Newall, at Gateshead-on-Tyne, whose telescope has an object-glass of 25 in. in diameter. The Naval Observatory glass has 26 in. clear aperture. It is not easy to realise what this power is, and what it promises. The reader must imagine himself within a dome, itself 41 ft. in diameter and 40 ft. in height, looking through a tube made of three sections of steel stretching away for 32 ft.; the whole telescope and its metallic base weighing about 6 tons.

In the dome, on a pier of mason-work, supported by a pedestal, which is one block weighing 7½ tons, stands the fine equatorial made by Merz and Mähler, Munich, at a cost of 6,000 dols., its object-glass being valued at more than half that sum. The work of this instrument under, successively, Profs. Ferguson, Walker, Hubbard, and Hall, has been chiefly upon the smaller planets, the asteroids, and comets. Mr. James Ferguson was the first American to discover an asteroid, Euphrosyne, in 1854, the thirty-first on a list which has been recently enlarged beyond even a hundred by Peters of Clinton and Watson of Ann

* Continued from p. 185.

Arbor. The object-glass of the equatorial has an aperture of 9·62 in. and a focal length of 14 ft. 4·5 in. Its powers of positive eye-pieces for use with its filar micrometer vary from 90 to 899.

Descending from the dome, and passing the superintendent's office, in which are a most excellent mean-time clock, with others, in the electric circuit with the clocks at the departments, ticking each, beat for beat, the visitor finds himself in the library, now embracing nearly 6,000 volumes. These are mostly works of the highest standard value, astronomical and meteorological observations and discussions, some being as old as the year 1482, others representing the full work of the European observatories and learned Societies to the present date.

From the library we pass into the transit-circle room, built in 1869, to admire the beautiful instrument, with its collimators and its chronograph. The focal length of the object-glass is 12 ft. 1 in.; its clear aperture 8·52 in.; and the power of its eye-pieces 135 to 396. The diameter of its circles at the outer edge is 45·30 in., and at the graduation 43·40 in., both circles being divided to every two minutes. The power of the reading microscopes is 45·3 diameters. Its collimators have a focal length of 2 ft. 11 in. This instrument, under Profs. Newcomb, Harkness, and Eastman, and their assistants, has had for its chief work the more accurate determination of the stars whose places are computed in the *Nautical Almanac*, and of those needed by the Coast Survey. The chronograph, made by Alvan Clark, is of the form known as the

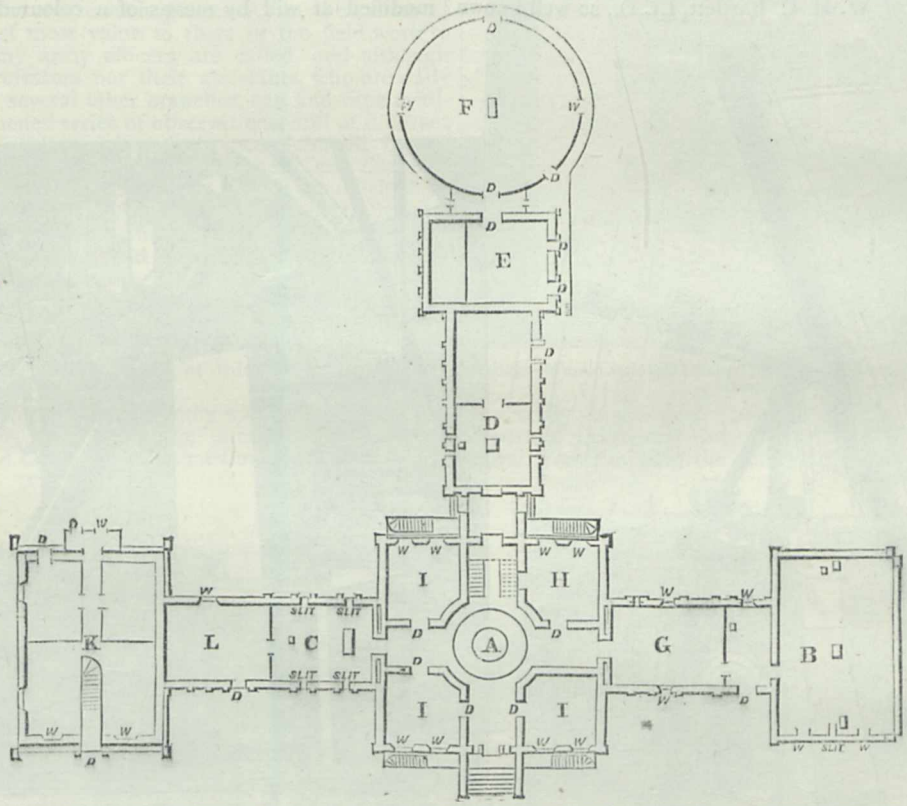


FIG. 6.—The United States Naval Observatory—Ground Plan. A, Pier of Equatorial. B, Transit Circle. C, Mural Circle and Transit. D, Prime Vertical. E, Computer's Room for Great Equatorial. F, Great Equatorial. G, Library. H, Superintendent's Office. I, I, I, Offices. K, Superintendent's Dwelling. L, Chronometer-Room. D, Door. W, Window.

Hipp chronograph, with modifications by Prof. Harkness.

Passing to the eastern wing there are seen, side by side, the mural circle and the smaller transit instrument, with their clock and chronograph. The mural circle has an object-glass of 4·10 in., and a focal length of 5 ft. 3·8 in., the highest power of the eye-pieces being 240. The diameter of the circle at its outer edge, where the graduation is placed, is 60·35 in. It is divided to every five minutes; the power of its reading microscope is 17·1 diameters. The transit has a focal length of 7 ft. 0·4 in., and its object-glass an aperture of 5·33 in.

The chronometer-room shows another and a distinct but important office of the observatory. The relation of all its work to the interests of practical navigation is sufficiently clear. More than 200 time-keepers have been at one time under care in this room. As many as eighty in 1867 were condemned and withdrawn from use. It is as gratifying as it is creditable to American skill to find that the chronometers of Messrs. Negus and Co., of New York, equal, if they do not excel, any of foreign workmanship.

From this room of the observatory the exact time is furnished daily at 12 M. to the Western Union Telegraph Office in Washington for dispatch throughout the United States. The naval officer, standing by the standard mean clock, and having the astronomical correction of that clock also before him, at three minutes before 12 M. calls the telegraph operator at his office, and, at the instant of noon, taps the electric key, giving the time to the company's office. He also drops the dome ball. The chronometer-room is under the very efficient direction of Commander A. W. Johnson, U.S.N.

The seventeen annual volumes of astronomical and meteorological observations now published best set forth in themselves the work of the observatory. The latest of

these volumes vie in extent and in value with the publications of Greenwich and Paris. The star catalogue, issued as Appendix No. 1 to the volume for 1871, embraces more than 100,000 observations, giving the places of 10,000 stars. It is the twenty years' work of Prof. M. Yarnall, embracing the reduction of his own observations and those of others from the year 1845 to 1871. The astronomer knows how to appreciate such a work.

Congress, in whose hands is the destiny of the institution, has promptly appreciated its claims, and does not withhold the liberal appropriations asked for it as due to astronomy and to this branch of naval efficiency.

West Point Observatory.—This observatory was erected in 1839 for astronomical purposes and the accommodation of the library of the Academy and its philosophical apparatus. The institution of an observatory is to be credited to Prof. W. H. C. Bartlett, LL.D., so well known for more than thirty years as its director. In 1840 Prof. Bartlett visited Europe for the United States Government, inspected and reported upon its chief observatories, submitting also a plan for an observatory at Washington, and purchasing for West Point whilst abroad its three large instruments, the equatorial, the transit, and the mural circle.

The transit instrument in the east tower was made yb Ertel and Son, and its object-glass by Merz and Mähler, at Munich, the whole cost being about 1,130 dols. It was mounted in 1843, the memorable year for observatories in the United States. Its object-glass has a clear aperture of 4·62 in., and a focal length of 76·75 in. It is provided with four eye-pieces and one dark glass, and has an illuminating apparatus, giving either a bright field with dark lines, or a dark field with bright lines, which can be modified at will by means of a coloured wedge. The

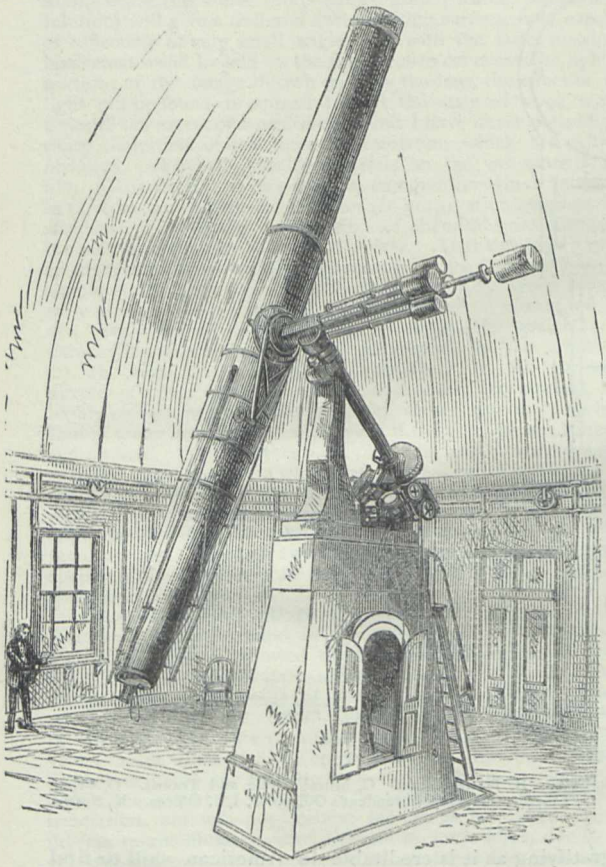


FIG. 7.—The Great Equatorial—United States Naval Observatory.

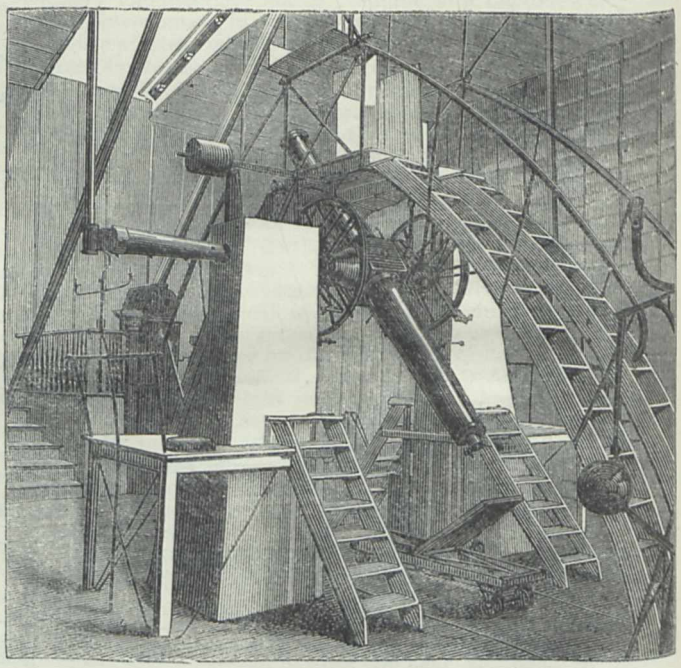


FIG. 8.—Transit Circle—United States Naval Observatory.

reticule has seven vertical and two horizontal lines. An extra vertical wire is driven in a horizontal direction by means of a micrometer screw, each division of which corresponds to 0″·334. It has a striding level, each small division being 1″·23 = 0·082*s*. The steel pivots have not sensibly changed their equality of dimensions since the instrument was mounted.

The west tower has the mural circle, by Troughton and Simms, of London. This was cast in one entire piece of brass. Its diameter is 5 ft., and its graduations are on two bands, one of gold, the other of palladium. The telescope has a clear aperture of 4 in., with a focal length of 60 in.

The central main tower has a revolving dome of 27 ft. in diameter, which rests on six 24-pound cannon-balls, turning between cast-iron annular grooves. The equatorial, made by Mr. Henry Fitz, of New York, has a focal length of 14 ft., and a clear aperture of 9¾ in. It has thirteen eye-pieces. The hour circle reads to two seconds of time, and the declination circle to twenty seconds of an arc, each circle being 20 in. in diameter. This instrument cost 5,000 dols.

The sidereal clock, by Hardy, has a Bond break-circuit attachment, and is connected with the several instruments by wires and break-circuit keys. Besides these there are valuable portable instruments in the observatory, which lends them from time to time to topographical and surveying parties in the west and north-west, or to stations of the Engineer Corps, like the one at Willett's Point, New York. Several valuable additions, including a Bond chronograph, the odolites, and sextants, have been made within the last two years.

The purposes of the observatory of the Academy are most effectively secured by confining its workings to the end of educating the cadets in the knowledge and practical use of the instruments. During the spring months they are taken in parties of two, three, or four to receive such instruction, and are required themselves to make observations with each instrument, and reduce them. During the summer encampment a month is devoted to further instruction in connection with a field observatory at Fort Clinton, where they use a field transit, zenith telescope, and other instruments. Each makes his own records, and works out his results for the ordinary problems of time, latitude, longitude. Würdeman of Washington is constructing for this field observatory a new transit and zenith telescope.

Although the chief design of the observatory has been from the first to secure such proficiency in the cadets as would prove of most value to them in the field work to which so many army officers are called, and although neither the professors nor their assistants, who are daily instructors in several other branches, can find time available for lengthened series of observations, still at different times valuable observations have been secured in the midst of pressing duties. Among these are those of Prof. Bartlett on the great comet of 1843, published in the Transactions of the American Philosophical Society, and recent observations under Prof. Michie and his assistants, Lieut. Bass and others, for determining the longitude of the observatory.

Annapolis Observatory.—We cannot complete this sketch of the United States Government observatories without a just, though necessarily very brief, notice of the observatory used in the instruction of midshipmen at Annapolis.

The Department of Astronomy was created in 1853, and until 1865 was in charge successively of Profs. Chauvenet and Coffin. Since that time a graduate of the Academy has from time to time been in charge. The course in astronomy is of necessity limited, most of the midshipman's time in this department being required for

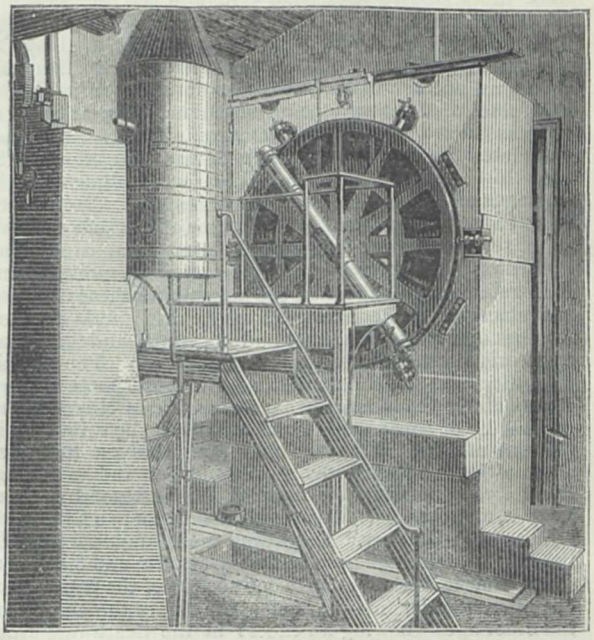


FIG. 9.—Mural Circle and Smaller Transit Instrument—United States Naval Observatory.

the study of practical navigation. We learn from the report of Lieutenant-Commander R. L. Phythian to Admiral Porter in 1869 the following facts:—"The instruments used in this department are the chronometer, the sextant, the artificial horizon, the azimuth compass, the surveyor's chain and compass, the theodolite, and the plane-table. The observatory is supplied with a sidereal clock, an equatorially-mounted telescope, and a superior meridian clock. These instruments are used in instruction only to show the midshipmen the principles of them. There is not sufficient time for them to acquire a practical knowledge of their use by observing with them."

Altogether the United States has reason to be proud of her observatories, and of the work already done by her astronomers.

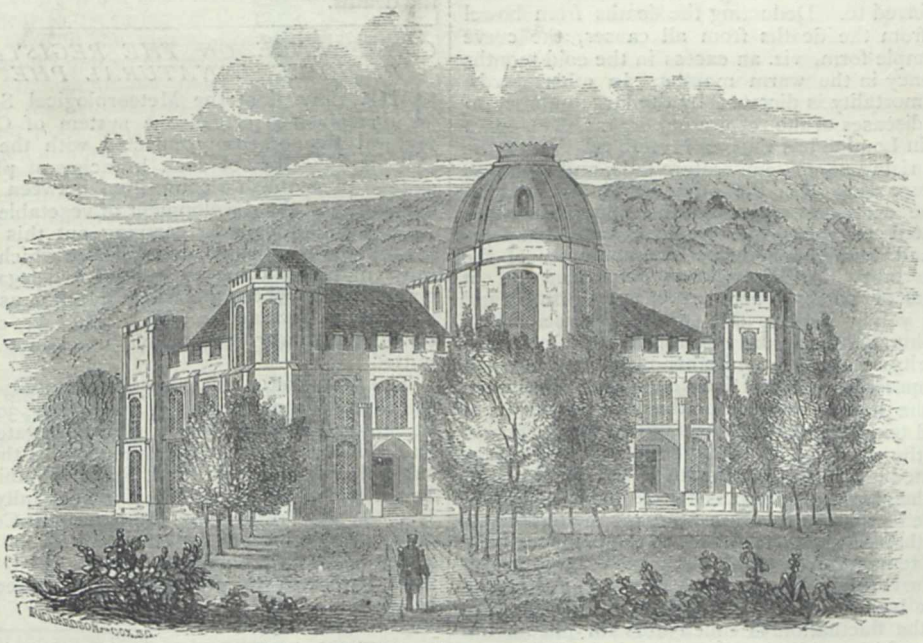


FIG. 10.—West Point Observatory—North Front.

THE RELATIONS BETWEEN HUMAN MORTALITY AND THE SEASONS OF THE YEAR

AT the anniversary meeting of the Scottish Meteorological Society, a very valuable paper was read by Dr. Arthur Mitchell, and the Secretary, Mr. Alex. Buchan, giving an account of their investigations on the subject of the influence of the seasons on human mortality at different ages as caused by different diseases. The authors have calculated the weekly average death-rate of London for the past thirty years for thirty-one diseases, together with the averages of temperature, moisture, rain, &c. Considering the weather experienced in the course of the year as made up of several distinct climates differing from each other according to the prevailing temperature and moisture and their relations to each other, the influence of these climates, characterised respectively by cold, cold and dryness, dryness and heat, heat, heat and moisture, and cold and moisture, on the mortality was pointed out. The weekly mortality from all causes and at all ages shows a large excess above the average from the middle of November to the middle of April, from which it falls to the minimum in the end of May; it then slowly rises, and on the third week of July shoots suddenly up almost to the maximum of the year, at which it remains till the second week of August, and thence falls as rapidly as it rose to a secondary minimum in October. Regarding the summer excess in the death-rate, which is so abrupt in its rise and fall, it was shown that it is wholly due to one section of the population, viz. infants under five years of age, none of the curves for the other ages showing an excess in the death-rate from all causes during the summer months; and it was further shown that the summer excess is due not only to the deaths at one age, but to the deaths from one class of diseases, viz. bowel complaints. The importance of weekly averages in discussing these sudden fluctuations of the death-rate to the changes of the weather was pointedly referred to. Deducting the deaths from bowel complaints from the deaths from all causes, the curve assumes a simple form, viz. an excess in the cold months and a deficiency in the warm months. In other words, the curve of mortality is dictated by the large number of deaths from diseases of the respiratory organs. The curve of mortality in London has thus an inverse relation to the temperature, rising as the temperature falls, and falling as the temperature rises. On the other hand, in Victoria, Australia, the curves of mortality and temperature are directly related to each other—mortality and temperature rising and falling together. The character of the curve of mortality in Victoria is impressed on it by the deaths of persons below the age of five; and among such young persons the special diseases which determine this influence are diarrhœa and dysentery. This peculiarity arises from its higher mean temperature, 57°·6, as compared with that of London, 50°·0. In London also during the hottest months of the year the curves of mortality and temperature rise and fall together, whereas in Victoria the curves are throughout the whole year directly related; for though doubtless the deaths from diseases of the respiratory organs fall as the temperature rises, and rise as the temperature falls, yet the number of deaths from these diseases is, owing to the comparatively high winter temperature, never sufficiently large to influence the curve of the whole death-rate. The curves of mortality for bronchitis and pneumonia at different ages prove that the fluctuation is much less for pneumonia than for bronchitis, and that the excess in both cases of infant mortality is great, but not nearly so great as the infant mortality for diarrhœa. The curves show that the maximum mortality from the different diseases group around certain specific conditions of temperature and moisture combined, the general result of which, as regards the principal diseases, may be thus roughly stated :—

Character of Weather	Maximum Mortality
Cold	Bronchitis, pneumonia, asthma, &c.
Cold and dry	Brain-disease, convulsions, whooping-cough
Warm and dry	Suicides, small-pox
Warm and moist	Diarrhœa, dysentery, cholera
Cold and moist	Rheumatism, heart-disease, diphtheria, scarlatina, measles, croup

The deaths from cancer and liver disease show no distinct relation to weather. The period of the year least marked by the occurrence of maximum mortality from any disease is the warm dry weather which prevails from the middle of May to the end of June. At this season the only maximum is a well-pronounced secondary maximum for measles; and the maxima for suicides and small-pox, which are, however, extended from the middle of April into these months. Convulsions, teething, and atrophy and debility have a secondary maximum in the warm moist weather of July and August. In the United States, where the heat is greater in summer, the secondary maximum for convulsions is more distinctly marked than that of London; and in Victoria the summer maximum is the only one that appears. The contrast offered by certain curves to each other in all points is very striking. Thus the curve for whooping-cough begins to rise above its average in the middle of December, attains its maximum in March and April, and falls to the minimum in September and October, whilst the curve for scarlatina is exactly the reverse of all this, having its minimum in spring and its maximum in autumn. It was inferred from the general teaching of the curves, that if a curve representing the progress of the death-rate from a particular disease were given for a place whose climate was known, though it might be impossible to name the exact disease, it would be possible to say with a considerable degree of certainty whether, for instance, the nervous system, or the respiratory organs, or the abdominal organs were involved in the disorder which caused the deaths.

CONFERENCE ON THE REGISTRATION OF PERIODICAL NATURAL PHENOMENA

THE Council of the Meteorological Society recently resolved to organise a system of Observations of Natural Phenomena, connected with the return of the seasons, as well as of such branches of physical inquiry as tend to establish a connection between meteorological agencies and the development of vegetable life.

As a preliminary to carrying out this intention they invited the various Societies before which such subjects most naturally come to nominate delegates to join a committee by whom the whole question as bearing upon agriculture, horticulture, &c., should be considered, and to whom also any written communications should be submitted.

The first meeting of this joint committee was held at the Office of the Meteorological Society, 30, Great George Street, on Thursday, July 2, when delegates were present and promises of co-operation read from the Royal Horticultural, Royal Agricultural, Royal Botanical, and other Societies. After the subject had been fully discussed the Rev. T. A. Preston, of Marlborough College, was requested to prepare a list of plants to be observed, and also to draw up a report on the same. Other gentlemen were requested to prepare lists of insects, birds, and animals.

THE SPECTRUM OF THE AURORA BOREALIS*

THE author's object in this paper is to make a small contribution towards the solution of the question, how the composition of the spectrum may be most correctly explained?

* By the late Prof. A. J. Angström.

It may be assumed that the spectrum of the aurora is composed of *two* different spectra, which, even although appearing sometimes simultaneously, have in all probability different origins.

The one spectrum consists of the homogeneous yellow light which is so characteristic of the aurora, and which is found even in its weakest manifestations. The other spectrum consists of extremely feeble bands of light, which only in the stronger auroræ attain such an intensity as enables one to fix their position, though only approximatively.

As to the yellow lines in the aurora or the one-coloured spectrum, we are as little able now as when it was first observed to point out a corresponding line in any known spectrum. True Piazzi Smyth (*Comptes Rendus*, lxxiv. 597) has asserted that it corresponds to one of the bands in the spectrum of hydrocarbons; but a more exact observation shows that the line falls into a group of shaded bands which belong to the spectrum, but almost midway between the second and third Herr Vogel has observed that this line corresponds to a band in the spectrum of rarefied air (Pogg. Ann. cxlvi., 582). This is quite right, but in Angström's opinion is found on a pure misconception. The spectrum of rarefied air has in the green-yellow part seven bands of nearly equal strength; and that the auroral line corresponds with the margin of one of these bands, which is not even the strongest, cannot be anything else than merely accidental.

Observations on the spectrum have not hitherto agreed with each other; partly, perhaps, because of the weak light of the object, but partly also, it may be, on account of the variability of the aurora. The red does not always appear, and when it does is often so weak that it cannot be observed in the spectroscope. If now it be assumed that the aurora has its final cause in electrical discharges in the upper strata of the atmosphere, and that these discharges, whether disruptional or continuous, take place sometimes on the outer boundary of the atmosphere, and sometimes near to the surface of the earth, this variability will easily show in the appearance of the spectrum what the observations appear to confirm.

If we consider the conditions under which the electric light appears on the boundary of the atmosphere, moisture in that region must be set down as nil, and consequently the oxygen and hydrogen there must alone act as conductors of electricity. Angström has tried to reproduce these conditions on a small scale. Into a flask, the bottom of which is covered with a layer of phosphate, the platinum wires are introduced and the air is pumped out to the extent of several millimetres. If the inductive current of a Ruhmkorff coil be sent through the flask, the whole flask will be filled, as it were, with that violet light which otherwise only proceeds from the negative pole, and from both electrodes a spectrum is obtained consisting chiefly of shaded violet bands.

If this spectrum be compared with that of the aurora, Angström thinks that the agreement between the former and some of the best established bands of the latter is satisfactory.

Lines		Wave-lengths		
Of the aurora spectrum	According to Barker	431	470·5	
	,, ,, Vogel	—	469·4	523·3
	,, ,, Angström	—	472	521
	,, ,, Lemström	426·2	469·4	523·5
	Mean	428·6	470·3	522·6
Of the spectrum of the violet light		427·2	470·7	522·7

In the neighbourhood of the line 469·4 Herr Vogel has moreover observed two weak light bands, 466·3 and 462·9. The spectrum of the violet light has also two corresponding shaded bands, 465·4 and 460·1.

Should the aurora be flamy and shoot out like rays, there is good reason for assuming a disruptive discharge of electricity, and then there ought to appear the strongest line in the line-spectrum of the air, the green, whose wave-length is 500·3. Precisely this has been actually observed by Vogel, and has moreover been seen by Angström and others.

Finally, should the aurora be observed as it appears at a less height in the atmosphere, then are recognised both the hydrogen lines and also the strongest of the bands of the dark-banded air-spectrum, as *e.g.* 497·3. There are found also again nearly all the lines and light bands of the weak aurora spectrum, whose position has with any certainty been observed.

There still remains the line in the red field, the wave-length of which, according to Vogel, may be valued at 630. Angström has chanced to see it only a single time, while on various occasions, when the aurora has shown red lights, he has found it impossible to distinguish any lines whatever in this part of the spectrum. The cause of this may be that while the red bands in the spectrum of the negative pole are broad and very feeble in light, the corresponding light in the aurora may be imperceptible in the spectroscope on account of the dispersion of the prism, although it is strong enough to give to the aurora a reddish appearance. Angström does not venture to decide whether the red line observed by Vogel coincides with the strongest of these bands, but so much is at least certain, that it may coincide with more than one of the bands to the red field of Plucker's air-spectrum.

In general it may be thus assumed that the feeble bands in the aurora spectrum belong to the spectrum of the negative pole, and that the appearance of this spectrum may be changed more or less by additions from the banded air-spectrum or the line-spectrum of the air.

But by this is not yet explained the one-coloured spectrum or the origin of the yellow line. The only explanation of the origin of this line which in Angström's opinion is in any way probable, is that it owes its origin to *fluorescence* or phosphorescence. Since fluorescence is produced by the ultra-violet rays, *an electric discharge may easily be imagined, which, though in itself of feeble light, may be rich in ultra-violet light, and therefore in a condition to cause a sufficiently strong fluorescence.* It is also known that oxygen is phosphorescent, as also several of its compounds.

There is therefore no need, in order to account for the spectrum of the aurora, to have recourse to the "very great variability of gas spectra according to the varying circumstances of pressure and temperature," a variability which according to Angström's twenty years' observations does not exist. Just as little can Angström admit that the way in which a gas may be brought to glow or burn, can alter the nature of the spectrum; since it is an established fact in physics that the state of light and of heat which puts a body into a glowing condition is unconnected in character with that which produces glowing.

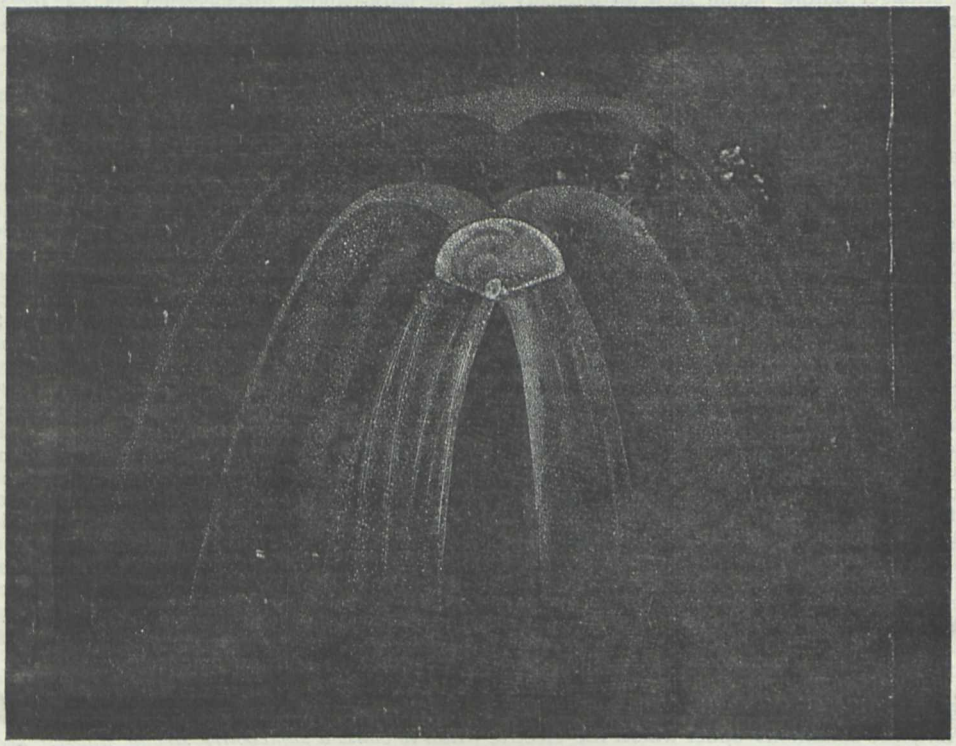
Angström does not entirely deny the possibility that a simple body by glowing in a gaseous condition will offer several spectra. Just as one simple body can form a chemical combination with another, and this body by glowing in a gaseous condition, so long as it is not decomposed, gives its own spectrum, so must it also be able to form combinations with itself—thus to form isomeric combinations—it being always supposed that it exists in the gaseous form and can maintain itself in a glowing condition without decomposition. In this way it is indeed possible to conceive an absorption for oxygen which belongs to ozone; but since ozone, as is well known, cannot maintain itself in a glowing condition, it is in vain to look for more than one spectrum of oxygen. There is, however, at least a possibility of obtaining several spectra from sulphur, while again with respect to carbon, which cannot even be exhibited in a gaseous condition, a like assumption in the author's opinion wants the support of experience.

THE COMET

WE have received from Mr. Lockyer, who has been observing the comet with Mr. Newall's 25-inch reractor, the accompanying rough sketch of its general appearance in that instrument. The drawing he states is only intended to show the features in their most general aspect, in order that the striking differences between the present comet and former ones may be apprehended.

His observations, to which we hope to refer at some length, extended over several hours on Sunday and Tuesday nights, and great changes were observed.

One of the new observations made was that a photographic plate exposed for ten minutes gave no results on the comet, while the dimmest of the seven stars in the Great Bear, inferior to the comet in brightness, recorded itself in two minutes' exposure.



Rough Outline Sketch of Head and Envelopes of Coggia's Comet as seen in Mr. Newall's 25-inch Refractor on the night of July 12.

It is hoped that the observations, made under first-rate atmospheric conditions, with the magnificent instrument with which Mr. Newall has endowed British Astronomy, will throw light upon cometary structure, and help to clear up many anomalies.

JASPER'S "BIRDS OF NORTH AMERICA"*

A SHORT time ago we gave our readers some account of the important work of the "Birds of North America," lately issued by Prof. Baird with the co-operation of some of the principal naturalists of the United States. It has just come to our knowledge that a rival work has been started with nearly the same title, concerning which it may be useful to such of our readers as turn their studies in an ornithological direction that we should say a few words.

Jasper's "Birds of North America" appears to have been started by an enterprising publisher at Columbus, Ohio, "to meet a common want and gratify a universal taste." It is issued in numbers, the first of which bears date Nov. 1, 1873. It is to contain coloured figures and descriptions of over 600 species, and a popular account of their habits and manners—likewise a general outline of the science of ornithology—all from the pen and pencil of Dr. Theodore Jasper, "who has made the study of ornithology the business of his life."

Now we have no desire at all to interfere with Mr. Jacob H. Studer's undertaking. We quite agree with Mr. Studer's notions that a knowledge of American birds is or should be a "common want," and we are also of opinion that a "universal taste" should be gratified if possible. At the same time we must be allowed to say, after examining what has yet appeared of Mr. Jasper's work, that, in our judgment, those who wish to become well acquainted with American ornithology had better consult Prof. Baird's volumes. Mr. Jasper, it is true, furnishes coloured figures of every species or proposes to do so. But these, prepared by chromolithography or some similar process, are not sufficiently carefully coloured for the discrimination of specific differences—at any rate as regards the smaller birds. And in every other particular Baird's "American Birds" is far superior. Mr. Jasper's work can indeed be hardly placed in the same category, the author being obviously acquainted with little more than the results of his own experience, whilst Prof. Baird and his coadjutors are fully up to the level of modern science.

* "The Birds of North America, drawn from life and uniformly reduced to one-quarter their natural size," by Dr. Theodore Jasper. In 4to. parts. Columbus, Ohio, 1873-74.)

NOTES

THE statue of Dr. Priestley will be unveiled at Birmingham on Saturday, Aug. 1 (the centenary of his discovery of oxygen). Prof. Huxley will make the presentation to the town, on behalf of the subscribers, and will deliver an address in the Town Hall.

WE understand that the recently established Stricklandian Curatorship in the Cambridge University Natural History Museum has been offered to and is likely to be accepted by Mr. Osbert Salvin, F.R.S., one of our most distinguished ornithologists.

LORD LILFORD has just returned from a natural history cruise in the Mediterranean, and amongst the most interesting specimens he has brought home with him is a pair of Audouin's Gulls (*Larus audouini*) from the small island of Toro on the coast of Sardinia, which he has deposited in the gardens of the Zoological Society. The rareness of these birds makes them of peculiar interest.

A LARGE collection of giraffes, antelopes, and other African mammals has lately been imported into Hamburg by Mr. C. Hagenbeck, the well-known dealer in animals of that city, from the Atbara district of Upper Nubia. Three of the finest giraffes have been secured by the Zoological Society, and are daily expected to arrive in London.

A REPORT is said to be current at St. Petersburg that the Austrian Polar Expedition, of which nothing has been heard for a considerable time, and respecting the safety of which apprehension is accordingly entertained, is lying off the coast of Novaya Zemlya.

THE Caen Academy of Science and Art proposes as the subject of the Le Sauvage prize, of the value of 4,000 francs, to be awarded in 1876, the question of the Function of Leaves in the Vegetation of Plants. The Academy does not want simply an exposition of the present state of Science on this important question; it requires, besides, from competitors, exact experiments performed by themselves, and new facts tending to throw light upon, invalidate, confirm, or modify doubtful points in the theories at present accepted. The memoirs ought to be sent to the Academy before Jan. 1, 1876.

A FIFTH "sub-edition" of Dana's "Mineralogy" has been issued, with an appendix, by Prof. Brush.

JOSHUA HOOPES, the last survivor of the old school of the botanists of Chester County, Penn., of which Darlington was the chief, and the "Flora Cestrica" the memorial, died on May 11 at the age of 86.

MR. HERBERT SPENCER has published in a separate form, with some additional correspondence and comments, the correspondence which was carried on in NATURE between himself, the "Quarterly Reviewer," Mr. R. B. Hayward, and others.

M. LEVERRIER has presented to the Council of the Observatory a new set of regulations for the better working of the establishment. In drawing out these regulations the illustrious astronomer took advantage of the visit he recently made to Greenwich Observatory.

MAGNETIC instruments are to be erected on a piece of ground situated between the Boulevard Arago and the Observatory Gardens, Paris. This land belongs to the French Government, which has given it up for the purpose mentioned.

M. FAYE has been nominated President of the Bureau des Longitudes. M. Janssen, who was a member of the Section of Geography, has been appointed by the Minister a member of the Section of Astronomy. There will be an election to fill up the place thus vacated. This is the first time that a member has been transferred from one section to another.

DR. GARRIGOU, of Bagnères de Luchon, has established, at his own expense, a laboratory for analysing the mineral waters of the Pyrenees. The laboratory is open to men of science for their own researches.

THE Worshipful Company of Clothworkers has founded a "Professorship of Textile Industries" in connection with the Yorkshire College of Science, with a stipend of 300*l.* a year and two-thirds of the students' fees. The stipulated qualifications for the post have been just announced. The selected candidate will be required to have a practical knowledge of all materials used in the woollen and worsted manufactures, and the selection of materials for special kinds of goods; to be able to give instruction in every department of weaving, including the practical handling of the loom; plain drawing, and analysis of patterns; to apply the laws of colour to the production of coloured designs, and to finish coloured designs on paper, prefiguring the woven fabric; to make all the calculations required in the manufacture of woollen or worsted goods; to explain and illustrate the processes of carding, combing, and spinning; and to give practical illustrations of scouring, fulling, and finishing. The chemistry of dyeing will be taught by the Professor of Chemistry. It will be a condition of appointment (*inter alia*) that the Professor is to give lectures at stated times upon improved modes of manufacture at other of the chief towns connected with the cloth-working industry both in Yorkshire and the west of England.

THE result of the Sandwell Park trial sinking for coal being that a seam 20 ft. 6 in. has been found at a depth of 418 yards, it is proposed to furnish an account of the fossils met with and the general character of the red rocks passed through. Prof. Ramsay and others have promised their assistance for this work.

URIAH A. BOYDON, of Boston, has deposited with the Franklin Institute the sum of 1,000 dols. to be awarded as a premium to "any resident of North America who shall determine by experiment whether all rays of light, and other physical rays, are or are not transmitted with the same velocity." The memoirs, which are to describe in detail the apparatus, mode of experimenting and results, are to be sent in to the secretary of the Institute by Jan. 1, 1875. The Institute is to appoint three judges, and has reserved to it the power to decide whether or not the recommendation of the judges shall be carried out. Should the judges think proper, they may require the experiments described in any of the memoirs to be repeated in their presence.

THE report of the State Board of Health of Massachusetts, 1874, says that a large part of the 450 analyses there given were performed by a lady in the laboratory of the Massachusetts Institute of Technology.

THE Geological Society of France intends to hold its annual session this year at Mons, immediately on the conclusion of the session of the French Association for the Advancement of Science. The meetings commence on August 30, and will last about a week, during which some interesting excursions have been arranged for.

IN the Engineering Department of King's College the following Physical Science Exhibitions will be given in October next. The Treake Entrance Exhibition of 20*l.*, also two Exhibitions of 30*l.* and 21*l.* will be given by competitive examination among the students matriculating in this department at that time, provided a satisfactory degree of proficiency is shown by the candidates. The examination will consist of four papers, two in mathematics, one in elementary mechanics and physics, and one in chemistry, and will take place on Thursday, October 1, and two following days.

THE Provost and Fellows of Worcester College, Oxford, have voted the appropriation of 2 per cent. of their revenues to non-collegiate University uses, and have resolved that this sum for the next five years shall be paid in equal proportions to the Bodleian Library and University Museum.

MR. F. BUTLER, B.A., of Worcester College, who obtained a first class in Natural Science at the recent examination at Oxford, has been appointed Natural Science Master of Reading School, and during the vacation a laboratory will be fitted up at the school under his supervision.

THE large and lucrative industry which has sprung up on the American coasts in the preservation of lobsters in tins, has induced some energetic persons to start a lobster farm near Boston, where an area of about 32 acres has been laid out and protected for the purpose of cultivating the lobster. On the seaward side it is closed by banks, having hatches or sluices so as to admit of the flow and ebb of the tide. Last summer about 40,000 lobsters, of all sizes, were deposited in this ground. The maimed and the halt and the lame and probably the blind are accommodated with quarters where they can recover their lost claws; and a *crêche* for the infantine population is provided, where they can increase without the ordinary dangers attendant on lobsterial infancy. Food, in the shape of refuse fish, &c., is liberally supplied to this interesting community. In the winter the managers evinced the natural deceitfulness of human nature by catching and scalding the lobsters on which so much attention had been lavished, and a fine harvest rewarded them; 15,000 fine lobsters were sold, and the success of the experiment seems complete. Besides lobsters, it is intended that the farm shall be turned to account by being made a nursery for fish of various kinds. As a matter of fact many eels and other fishes were caught in the spring. The venture seems a very successful one; and in view of the enormous drain on the natural lobster grounds of America, it is very necessary that some such steps should be taken, as a supplement to the regulations proposed to prevent overfishing, and fishing in the breeding season.

THE suggestion has been made that kangaroos might be generally cultivated in parks and other enclosures in this country; and it is probable that they would prove quite as useful as deer. A French naturalist, M. Cornély, has recently published some novel information on the subject, which seems to show that the proposal is perfectly feasible in every way. The experience of the various zoological societies in Europe shows that this marsupial will thrive and breed in our climate, damp being the only condition which is fatal to it. It will bear great extremes of heat and cold without injury. M. Cornély says that they are not destructive to trees and shrubs, and that if any individuals contract the habit of barking trees, they can be broken of it by shutting them up for two or three days without food. On being released they are so eager in search of grass that they do not touch the trees. As an ornamental adjunct to an English park, the presence of kangaroos would prove very valuable; their skins are highly prized on account of the quality of the leather, and most probably the principal obstruction to the more general cultivation of the animal is the prejudice that exists against the introduction of novelties.

A SEVERE earthquake is reported to have occurred in Utah at midnight on June 18.

WE learn with great pleasure that during the last three years there has been a very successful class for botany in connection with the Royal Veterinary College. From some notices of excursions made during the present summer which have been sent us, we see the field-class is one of the largest in London, or anywhere else we should think, and that the excursions are made the means of valuable training as well as of conveying solid information.

THE Council of the Institution of Civil Engineers has just awarded the following, among other premiums and prizes:—A Telford Medal and a Telford Premium to Joseph Prestwich, F.R.S., Assoc. Inst. C.E., for his paper On the geological conditions affecting the construction of a tunnel between England and France. A Watt Medal, and a Telford Premium, to Alexander Carnegie Kirk, Assoc. Inst. C.E., for his paper On the mechanical production of Cold. A Telford Premium to Major James Browne, R.E., Assoc. Inst. C.E., for his paper On the tracing and construction of roads in mountainous tropical districts.

THE following is a translation of the telegraphic despatch received in Paris by Gen. Morin from H.M. the Emperor of Brazil:—"Service from Rio de Janeiro to Paris *viâ* Falmouth, June 23, 6 o'clock. Electric telegraph established from Europe to Brazil. In addressing you my congratulations on this victory of science, I beg you to communicate my satisfaction to all your colleagues of the Academy of Sciences, to whom I owe so many marks of good-will. Don Pedro." The Academy immediately replied:—"The Academy, moved by his Majesty's remembrance, offers him its thanks, its respects, and its vows."

WE would strongly urge on our readers' attention the appeal made through the daily papers by Mr. C. R. Markham, F.R.S., on behalf of the Cameron-Livingstone expedition. A letter from Lieut. Cameron, dated Ujiji, Feb. 28, tells of his having secured Dr. Livingstone's map and journal from Mikandany, which he was to send home in a few days. "The fish of Tanganyika," he states, "are more like sea than fresh-water fish. The Tanganyika is a veritable sea. I will send home a bottle of lake-water to be analysed. I cannot understand, receiving as it does rivers that flow through a salt soil, why the waters of the lake should not be salt. I believe that it is gradually being filled up."

THE Report of the Commissioners of Fisheries for the State of New York states that in 1872 upwards of seven and a half millions of young shad were hatched and turned into the river Hudson at the cost of the State; and five millions were added in 1873. In the spring of the latter year, several hundred thousand shad were transported into California and into the great American lakes, where it is hoped they will become fairly acclimatised. The Sacramento River Salmon, and the Whitefish (*Coregonus albus*) have, in return, been introduced from the lakes and rivers of the West to the Eastern States. The enactment of a close time, during which the shad may be allowed to proceed unmolested up stream to spawn, is urgently desired, otherwise the natural increase of the fish can never occur, and the results of the artificial culture and propagation are nullified. The efforts of the Commissioners, who have erected extensive hatching premises at the cost of the State, have resulted in much more light being thrown on the subject of pisciculture. So thoroughly is the process of artificial spawning and fecundation carried out, and so carefully are the after stages of development assisted, that nearly cent. per cent. of the eggs taken are actually hatched. Under ordinary circumstances hardly twenty per cent. of the eggs are hatched. The importance of this system in re-stocking barren or depopulated waters cannot be over-estimated; but its results can never be fully successful until all impediments to the ascent of fish in the spawning season are removed; and when this is the case, artificial propagation will be no longer necessary.

MR. SETH GREEN, the well-known American pisciculturist, proposes that some enterprising persons should turn their attention to frog culture; and he gives careful directions for procuring and treating the spawn and frogs. The spawn will hatch in about fifteen days, and if the tadpoles and young frogs are placed in a suitable position it is calculated that they may be easily reared, and a large profit made. The mode of feeding the frogs is to place

pieces of meat, or other substance, to attract the flies, upon which the frogs feed; they will also eat the maggots of decayed meat, and even the meat itself. It appears that the demand for rogs in America is increasing, and in that case a frog-farm might be made a good investment.

OF the 120,000 salmon eggs which were sent from England to New Zealand in the winter of 1872, only about 60 are now alive. Although the ship *Oberon* by which they were sent was only 93 days on the passage, she was delayed on her arrival at Dunedin in consequence of a quantity of gunpowder being on board, which was obliged to be discharged before she could get into port. Probably the eggs were not properly fertilised; though several boxes of ova which were kept packed in ice in England for 108 days under exactly similar conditions, produced a good percentage of fish. The Government of New Zealand intend to repeat the experiment this year, when Glasgow will be the port of despatch.

ON July 1 severe thunderstorms were felt in several parts of southern France, principally in and around Montpellier, which seems to have been a centre of electric manifestations. But the harm done was principally owing to the hailstones, which have been numerous and of considerable size, many of them reaching the bulk of a marble. Many crops were damaged, and even in some instances completely destroyed. These hail clouds travelled at a rapid rate from the eastern Pyrenees, near the Rhone, in a north-eastern direction for more than a hundred miles with a breadth of not more than eight or nine miles. A map will be published in the *Atlas Météorologique* of France, which was founded by M. Leverrier in 1864, and was published in 1864-68. The volume for 1869 will be issued shortly, and will contain the most notable facts for 1870-71. The publication, which has been stopped since M. Leverrier left the Observatory, will be resumed yearly henceforth, the Versailles National Assembly having granted the necessary funds. It has been remarked already by M. Charles Martin and the two Becquerels that hailstorms are always connected with thunderstorms, and follow mostly a strongly zigzag line, almost always recurring in a number of chosen spots, for which they seem to feel an irresistible attraction. Woods are very seldom touched by them, a fact which has induced MM. Becquerel to advise farmers to grow trees in order to be protected against hailstones. M. Arago encouraged some years ago a scheme for erecting captive balloons with an iron rod, connected with the earth by an iron chain, in order to provoke electrical discharges and suppress the cause of hail-production. The proposal seems to be rather daring, but the above statements render it desirable that it should at least be tried. Aiming at certain spots in preference to others, the efficiency of protection is sure to be easily tried. M. Colladon, a Genevan physicist, has published many experiments on the fall of lightning on trees. He supposes that poplars are really very attractive, and that they may effectually render the same service as true lightning conductors, if plates of iron are connected with the trunk and earth. These suggestions are very likely to be tried on a grand scale.

ICEBERGS seem to be unusually plentiful this season; a despatch from New York states that several ships have encountered them in uncommonly large numbers and of very unusual size.

MESSRS. TRÜBNER & Co. have in the press "Tea, Coffee, and Cocoa," a practical treatise on the examination of tea, coffee, and cocoa, by Mr. J. A. Wanklyn, M.R.C.S.

ANOTHER supplement, No. 37, to Petermann's *Mittheilungen* has just been issued, containing a long account of Carl Mauch's travels in the interior of South Africa in the years 1865-72. The accompanying map illustrates a journey made by Mauch in 1871-72, from Simbabye in 20° 10′ S., and 31° 40′ E. in a north and east direction, to Senna on the Zambesi, in 17° 20′ S., 35° 8′ E.

IF anyone wants to see how lamentable is the absence of practical work in the examination system of the University of London, let him get "Questions in Chemistry and Natural Philosophy given at the Matriculation Examination of the University of London from the year 1864 to June 1873, classified according to the syllabus of subjects," by C. J. Woodward, B.Sc. (Simpkin, Marshall, & Co.) We say nothing against the book itself, which is a creditable compilation of its kind, but the system capable of giving birth to such a text-book must be an unmitigated encouragement to "Cram."

A TELEGRAM dated Singapore, July 2, states that H.M.S. *Basilisk* had arrived there, having successfully completed a survey of the previously unknown north-eastern shores of New Guinea. Capt. Moresby reports that the existence of a new and shorter route between Australia and China is an established fact.

THE additions to the Zoological Society's Gardens during the past week include a Branded Ichneumon (*Herpestes fasciatus*) from West Africa, presented by Lady Sheffield; a Rose-ringed Parrakeet (*Palæornis docilis*) from the Zambesi River, presented by Mrs. Loveday; a Chimpanzee (*Troglodytes niger*) from West Africa; a Spectacled Bear (*Ursus ornatus*) from the Upper Amazon; an Eyra Cat (*Felis eyra*)) from South America; a Nisnas Monkey (*Cercopithecus nisnas*), an Eleonora Falcon (*Falco eleonoræ*) deposited; two Pumas (*Felis concolor*), and nine Rosy-billed Ducks (*Metopiana peposaca*) born in the gardens.

SCIENTIFIC SERIALS

THE *Journal of the Chemical Society* for June contains the following papers communicated to the Society:—On the cobalt bromides and iodides, by Walter Noel Hartley. The bromide is prepared by allowing metallic cobalt to stand in a dish with bromine and water for a week or so, when a purple solution is obtained which becomes blue after dilution and filtration. When evaporated over sulphuric acid, purple-red prismatic crystals separate, having the formula $CoBr_2.6H_2O$. When heated to 100° the salt loses 4 molecules of water. The iodide obtained in the same manner forms a mass of highly deliquescent green crystals. Heated to 100° in the air a basic salt is produced; on adding water and filtering a red oxyiodide is obtained, having possibly the formula Co_2I_3O. The green crystals have the formula $CoI_2.2H_2O$; an iodide, $CoI_2.6H_2O$, of a dusky red colour also exists, and likewise the anhydrous salt CoI_2, which is described as a black amorphous substance.—Note on the solubility of plumbic chloride in glycerin, by Charles H. Piesse. The author has made quantitative determinations of the amount of $PbCl_2$ dissolved by pure glycerin and by mixtures of glycerin and water. The mean of two experiments gives 1·995 as the amount of $PbCl_2$ dissolved by 100 parts of glycerin. The solubility is not perceptibly increased by the temperature. Experiments were also made with mixtures containing respectively 50, 75, and 87·5 per cent. of water, and the amount of $PbCl_2$ dissolved agrees very closely in each case with the number obtained by adding the amount of the salt dissolved in the water to the amount dissolved by the glycerin, the solubility in water being taken at 0·733 per cent.—On the products of the decomposition of castor oil. No. 2. The distillation of sodium ricinoleate, by E. Neison. The author's experiments confirm the statements of Bouis, that the sodium salt named yields methyl-hexyl ketone on destructive distillation. The results obtained by Städeler, who got by this reaction only heptylic aldehyde, are explained by a difference in the nature of the soap used.—Note on a reaction of gallic acid, by Henry R. Procter. When a solution of potassic or sodic arsenate is added to one containing gallic acid and the mixture exposed to the air, oxygen is absorbed, and an intense green colour produced. Dilute acids change the colour to purplish red—strong H_2SO_4

and HNO_3, and boiling HCl change it to a pale yellow. The colour is also destroyed by reducing agents.—On ozone as a concomitant of the oxidation of the essential oils. Part I. by Charles T. Kingzett. The author first determined the amount of oxygen absorbed by ether, oil of turpentine, and various essential oils. Various reactions of the so-called ozonised oil of turpentine have been studied. The oxidised substance resembles both ozone and hydrogen peroxide in certain properties, but its aqueous solution retains its properties after long-continued boiling. The substance is destroyed also by MnO_2 and by heating with $ZnCl_2$. The author concludes from his experiment that the supposed ozone is an oxidised compound of the turpentine oil, $C_{10}H_{16}O.H_2O$.—It is much to be regretted that the Society still finds it necessary to advertise on the wrapper of the present number (as also of the last) a list of books missing from the library.

American Journal of Science and Arts, June.—The first article is by W. Hilyard, Univ. of Michigan, On some points in Mallet's theory of vulcanicity. He gives a *résumé* of the state of the question. Among other points considered Mr. Hilyard says:—"While Mr. Mallet's theory accounts satisfactorily for earthquake phenomena and volcanic activity as manifested since the cessation of fissure eruption; and also for the gradual or sudden depression of both large and small areas, even subsequent to that time; it makes no provision for their elevation, and therefore leaves unexplained the numerous oscillations of level of which we find the record down to our own time. In assuming the movements as taking place exclusively within the solid shell, he (unnecessarily, it seems to me) leaves a point open to objection." . . . "At the first blush the 'squeezing out of sub-mountain liquid matter' assumed by Leconte as the consequence of the folding and fissuring of strata by tangential thrust, appears natural enough. Yet it seems hardly possible that the same force which makes and elevates mountain-folds (being the result of interior shrinkage) should at the same time serve to compress the interior liquid, unless either such folding occurs beneath the general level of the liquid; or the latter is locally confined; or the movement is so brusque or cataclysmal that viscosity would prevent the lateral or downward escape of the liquid rock." While the assumption of locally limited fire seas, as proposed by Dana, would remove the difficulty, calculation shows the required size of the seas to be such that they would approach to nearly a general undercrust fluidity.—In the second article Mr. L. Lesquereux replies to Dr. Newberry's objections to the Colorado Lower lignite formation being referred to the period of the Lower Eocene. He shows that many of the species it contains are common to Alum Bay and Mount Bolca, and he objects to Heer's statement that the floras of these two localities have "a distinctly tropical and Indo-Australian character." The next article is a continuation of Mr. C. H. Hitchcock's paper On the Helderberg rocks of New Hampshire. The beds in question border on the line of the Ammonoosuc River in three areas, the Littleton, North Lisbon, and Lyman. Of the fossils Mr. Billings says: "I do not consider the fossils sufficient to decide the age of the rock very closely, but only that it is Upper Silurian or Lower Devonian.' The communication, which occupies twenty pages, is illustrated with map and sections.—A description of a new fossil resin, by O. Loew, named by him Wheelerite. Its formula is C_5H_6O, and it melts at 154° C.—The next article is a completion of Mr. W. M. Fontaine's paper On the great conglomerate on New River, West Virginia. This series, while in some features resembling the lower coal rocks, is distinguished by an almost entire absence of shales. The study of it has led to the consideration, "Does not the successive formation of coal on an extended scale along the south-west border of the Appalachian coal-field, commencing in the Devonian period, point to the existence at this time of a continental mass nearer than the azoic of Canada?"—On a felspar from Bamle in Norway, by G. W. Hawes.—Notes on some fossils in Illinois State Geological Reports, vol. v., by F. B. Meek.—Chemical composition of the wood of Acrogens, by C. W. Hawes. The analyses show that the wood of Acrogens does not differ in ultimate composition from forest trees.—Under the head "Scientific Intelligence," there is a note that a skeleton of a whale (*Beluga vermontana*) has been found at a depth of 12 ft. 6 in. in clay of the Champlain period, at Jacquet River, Dalhousie, New Brunswick.—The flora of the Dakota group of the Cretaceous is, according to Mr. Lesquereux, remarkable for the absence of any European species of the same age.

THE *Geographical Magazine*, July.—This number opens with an interesting sketch of the history of Indian Marine Surveys.—Col. H. Yule, C.B., contributes an abstract from the *Bulletin* of the St. Petersburg Geographical Society of Mr. F. Paderin's account of his visit to the site of Karakaroum in 1873, which is illustrated by a sketch-map.—Another paper by Col. Yule contains some valuable information concerning the wonderfully accurate *Atlas Sinensis* (1655) of the Jesuit Martin Martini.—A number of valuable notes on the Kashgar Mission are given in the form of letters from Lieut.-Col. Gordon and Capt. Biddulph.—Baron von Richthofen sheds considerable light on the question of land communication between Asia and Europe. No one is entitled to speak with more authority than this great explorer of China, and he distinctly states that "the trade-route from Si-ngan-fu, past Hami, to Kuldja, is the best natural line for a railway from China to Europe." He is confident of the practicability of the undertaking.

THE *Journal of Botany*, May, June, July.—The number for May commences with a short sketch of the life of a little-known botanist, William Sherard, a contemporary of Ray, who died in 1728, and bequeathed his library and herbarium to the University of Oxford, together with an endowment of 3,000*l.*, for the Professor of Botany.—Mr. F. A. Lees has a useful paper On the flora of the Yorkshire coal-field.—Prof. Thiselton Dyer appends some remarks to a translation of M. Vesque's paper On new species of Dipterocarpus, from the *Comptes Rendus*, some of M. Vesque's names having a claim of priority over those published by Prof. Dyer in the preceding number of the *Journal*, while others appear identical with previously described species, and to have been published on insufficient grounds.—In the number for June the papers are mostly of a character to interest species-botanists only.—Mr. J. G. Baker describes some new species of Dracæna from Tropical Africa.—The same remark may be applied to the number for July, with the exception of an account of the Botanical Congress at Florence, continued from the preceding number, and reprints of the Official Reports of the Keeper of the Botanical Department of the British Museum, and the Curator of the Herbarium and Library at Kew for 1873.—One or more plates in every number now add to the permanent value of this admirably conducted magazine.

IN the *Scottish Naturalist* for July, we find papers on Scotch zoology, phytology, and geology. We would call special attention to one by Mr. G. Sim, On the food and use of our rapacious birds, an eloquent appeal for the protection of our "Raptores," which are now becoming scarcer every year. From an examination of the stomachs of 305 birds which have passed through his hands during the last ten years, eagles, buzzards, ospreys, falcons, merlins, kestrels, sparrow-hawks, owls, &c., the author has come to the conclusion that the injury done by these birds to the farmer and game-preserver is very small compared to the benefit, by far the most abundant articles of their food being mice, shrews, and various insects. Even when hawks do kill game, he maintains that it is the weakly and sickly birds that fall victims.—Mr. F. Smith concludes his paper On the geology of the Earn Valley, and Dr. Buchanan White and Dr. Sharp give further instalments of the Lepidoptera and Coleoptera of Scotland.

THE *Transactions of the Linnean Society* has now entered on its thirtieth volume. The first part, just published, contains Mr. J. Scott's paper On the tree-ferns of British Sikkim, illustrated with eighteen plates; a paper On some recent forms of *Lagenæ* from deep-sea soundings in the Java seas, by F. W. O. Rymer Jones, with one plate; an enumeration of the Orchids collected by the Rev. E. C. Parish near Moulmein, by Prof. H. G. Reichenbach, f., with six plates; and a most elaborate and laborious monograph of the habits, structure, and relations of the three-banded armadillo, *Tolypeutes conurus*, by Dr. James Murie, with seven plates.

Memorie della Societa degli Spectroscopisti Italiani, May.—Secchi and Tacchini contribute a table showing the solar prominences for November and December 1872, in which there is a marked aggregation of prominences on either side of the solar equator and a total absence at the poles.—There is also a coloured plate of some prominences and faculæ, by Gautier.—Schiaparelli gives an account of Capt. Tupman's observations on shooting stars, accompanied by a table showing the length of the trajectory in degrees and duration of numbers of meteorites.—Lorenzoni gives a discussion of the results of the researches at the Vienna University on the orbits of meteorites, with a table showing the elements of sixteen meteor streams.—Prof. Bre-

dichin gives his solar observations for last autumn, together with a discussion on the formation of prominences.—Tacchini gives his observations on solar spots for May 1874.

Astronomische Nachrichten, No. 1,997.—This number contains an account of the observations of the minor planet Virginia since its discovery in 1857, and the following elements are calculated :—

1874, June 19, Berlin.

	°	′	″
M =	322	19	49·80
π =	10	0	42·76
Ω =	173	27	39·0
i =	2	47	53·5
φ =	16	37	4·3
μ =	822″·710835		
Log. *a* =	0·4231729		

An ephemeris is also added for the opposition this summer.—Doberck contributes new elements for Comet I., 1824, deduced from Rümker and Sir J. Brisbane's observations.—Some observations of position of Henry's Comet, 1873, are given by J. J. Plummer.—No. 1,998 contains a paper on the photographic processes applicable to the transit of Venus.—C. S. Sellack contributes a paper on the direct photography of the solar protuberance.—A communication on the elements of the orbit of Alceste is made by A. Hall, corrected by observations made at Washington.—M. Flammarion gives the following periods of double stars :—

	Years.	Apparent semi-axis major.	Perihelion passage.
		″	
ξ Ursa Majoris . .	60·60	2·45	1873·40 at 358
ζ Horculis	34·57	1·19	1864·35 at 298
η Corona Bos . . .	40·17	0·865	1853·95 at 287
γ Virginis	175·	3·385	1836·45 at 320

No. 1,999. — This number contains an ephemeris of the five inner satellites of Saturn from June 1 to Oct. 28, by A. Marth, and a discussion of the various theories of comets, by W. Zenker.—In No. 2,000 is an account of some spectroscopic observations on certain variable and other stars, by H. C. Vogel; the author gives the wave-lengths of the lines in some cases.—G. Strasser gives a number of observations on comets (Winnecke and Coggia), together with the list of comparison stars.—C. H. F. Peters contributes observations on some of the planetoids, and A. Krüger gives some position observations of Coggia's comet.

Justus Liebig's Annalen der Chemie und Pharmacie, Band 172, Heft 1. This number contains the following papers :—A condensation product of glyoxal, by Hugo Schiff. Glyoxal is dissolved in five or six volumes of strong acetic acid and a stream of hydrochloric acid gas passed through the solution for about fifteen minutes. The solution on standing deposits a white substance, which was found to possess the composition $C_{12}H_{14}O_{13} = 6C_2H_2O_2 + H_2O$, and which the author proposes to name *hexaglyoxal hydrate*. Treated with acetic anhydride, one atom of hydrogen is replaced by acetyl, giving the compound $C_{12}H_{13}(C_2H_3O)O_{13}$; similarly with benzoyl chloride the compound $C_{12}H_{13}(C_7H_5O)O_{13}$ is produced. The author concludes from these reactions that the substance contains *one* semi-molecule of hydroxyl.—Improved air-bath for heating sealed tubes, by J. Habermann.—On the oxidation products of amylum and paramylum with bromine, water, and oxide of silver, by the same. Amylum yields dextronic or glucosic acid $C_6H_{12}O_7$, and paramylum the same. The calcium, barium, and cadmium salts of the acids were examined.—On the sodium contained in the ashes of plants, by G. Bunge. The author is of opinion that the result obtained by Peligot, who found that the ash of beans was free from sodium, is due to some error in the method of determination employed. An examination of the analytical method employed by Peligot has been undertaken, the results of the analysis of the ash of cows' milk being given as an example. This examination leads the author to the conclusion that by determining the alkalies merely in the aqueous extract of the ash, not only is a low value obtained, but the ratio between the two bases is a false one. Details of the method of analysis adopted are next given, and its application to the ash of beans, clover, meadow grass, apples, and strawberries. The author remarks that by his analyses Peligot's conclusions are not refuted, but at the same time they cannot be considered as established on the grounds of the analyses made by that chemist.—On oxysulphobenzide and a new derivative of this substance, by Dr. J. Annaheim. The following substances are described in this paper :—Oxysulphobenzide, $\left(\begin{matrix}C_6H_4HO\\C_6H_4HO\end{matrix}\right\}SO_2\Big)$; Phenoltrisulphonic acid, $C_6H_2\overset{HO}{(SO_3H)_2}SO_3H$; Tetrachloroxysulphobenzide, $\left.\begin{matrix}C_6H_2Cl_2OH\\C_6H_2Cl_2OH\end{matrix}\right\}SO_2$, and the corresponding bromine and iodine compounds; methyloxysulphobenzide, $\left.\begin{matrix}C_6H_4OCH_3\\C_6H_4OCH_3\end{matrix}\right\}SO_2$; the dinitromethyl compound, $\left.\begin{matrix}C_6H_3NO_2OCH_3\\C_6H_3NO_3OCH_3\end{matrix}\right\}SO_2$; the diamido compound, $\left.\begin{matrix}C_6H_3NH_2OCH_3\\C_6H_3NH_2OCH_3\end{matrix}\right\}SO_2$; the ethyl compound, $\left.\begin{matrix}C_6H_4OC_2H_5\\C_6H_4OC_2H_5\end{matrix}\right\}SO_2$ the corresponding amyl compound, and their nitro-, amido-, and brominated substitution derivatives.—The concluding paper is by Otto Hecht and Julius Strauss : On normal hexylene and some of its derivatives. The authors have examined the dibromide $C_6H_{12}Br_2$, and the monobromide, $C_6H_{11}Br$.—A plate illustrating Habermann's paper On an improved air-bath accompanies the present part.

SOCIETIES AND ACADEMIES

LONDON

Anthropological Institute, July 1.—Special meeting at the East London Museum, Bethnal Green.—Prof. Busk, F.R.S., president, in the chair.—Col. Lane Fox read a paper on the principles of classification adopted in the arrangement of his anthropological collection exhibited in the East London Museum. The paper contained three divisions, viz. Psychological, Ethnological, and Prehistoric. The author's object had been, during the twenty years he had been occupied in forming the collection, to select the specimens not so much for their rarity or beauty as for their utility in illustrating the succession of ideas by which the minds of men in a primitive condition of culture had progressed from the simple to the complex. Contrary to the usual system of arrangement, which was geographical, and was to be found in most ethnographical museums, the author's primary arrangement had been guided by form, *i.e.* spears, bows, clubs, &c. had been placed by themselves in distinct classes; and within each class there were sub-classes for special localities, and in each of the sub-classes the specimens were arranged according to their affinities. It was shown how far the arts of existing savages might be employed to illustrate the relics of primeval men. In studying the evidence of progress, the phenomena that might be observed were (1) a continuous succession of ideas; (2) the complexity of the ideas in an increasing ratio to the time; (3) the tendency to automatic action upon any given set of ideas in proportion to the length of time during which the ancestors of the individual have exercised their minds in those particular ideas. After a lengthened elaboration of those psychological considerations Col. Fox pointed out that the forms of implements used by savage races, instead of affording evidence of their having been derived from higher and more complex forms, showed evidence of derivation from natural forms, such as might have been employed by man before he had learned the art of modifying them to his own use; and that the persistency of the forms is in proportion to the low state of culture. That conclusion was illustrated by reference to the Australian and other savage peoples. The third and concluding part of the paper was devoted to the correlation of modern implements in use among existing savages with those of Prehistoric times.—The reading of the paper was followed by an explanation of the collection, which was arranged with a view to illustrate the principle of sequence contended for by the author.

PHILADELPHIA, U.S.

Academy of Natural Sciences, Dec. 23.—Dr. Ruschenberger, president, in the chair.—Prof. Cope made some remarks on fishes from the coal measures at Linton, Ohio. He stated that Prof. Newberry, Director of the Geological Survey of Ohio, had sent to him numerous specimens of fishes and batrachians for determination and description. Among these he had discovered batrachians which were labelled and had been described as fishes (*Pygopterus scutellatus* Newb.), and fishes (*Conchiopsis* and *Peplorhina* Cope) some of which were labelled "Amphibian or Reptilian." Having determined the latter to be fishes and described them, he called attention to a note of Prof. Newberry on the latter, in which he states (1)

that *Peplorhina anthracina* is a batrachian; (2) that it is identical with *Conchiopsis exanthematicus*; (3) that *C. filiferus* is *Coelacanthus elegans*; (4) that the dentition described by him is not that of *Coelacanthus*; and that (5) the genus is the same as that described by Agassiz forty years ago as *Coelacanthus*. To these propositions Mr. Cope replied that (1) additional evidence derived from two specimens of *Peplorhina anthracina*, recently studied, confirms the view that it is a fish, which evidence is given below; (2) that neither of the two specimens exhibits in its cranial bones the characters of *C. exanthematicus*, though both sides are exhibited. They show, however, that the latter should be referred to the genus *Peplorhina*, since among other points they present the same type of teeth, which I find labelled on one of them "ova?" (3) Mr. Newberry's identification of the species *C. filiferus* with *Coelacanthus elegans* is doubtless correct; but (4 and 5) its reference (with that of similar species) to Agassiz's genus is not warranted until it is found to possess an osseous natatory bladder, and osseous ribs and the type of dentition are discovered in *Coelacanthus granulatus*, the type of the genus. The characters relied on as indicative of the reference of *Peplorhina* to the fishes, are (1) the presence of opercula like those of *Conchiopsis*; (2) the presence of jugular bones, and (3) of oval imbricated scales; (4) the absence of ambulatory limbs. The thin scutiform cranial bones, the dense patch of vomerine teeth, and the mucous ducts of the bones and scales were all ichthyic characters. As no limbs had been discovered in three specimens preserved in the appropriate regions, their nature, if existing, could not be determined at present.—Prof. Cope brought before the Academy some results derived from study of material obtained by him during the preceding summer in the Miocene formations of Colorado. He announced the discovery of the first fossil monkey of the Miocene of America, giving it the name of *Menotherium lemurinum*. He regarded it as allied to the *Tomitherium* of the Bridger Eocene, and as the representative of the more numerous group of the lemuroids, which he had discovered in the latter formation. Size, that of a domestic cat. He stated that his recent discovery of snakes, lizards, and lemurs of forms allied to those previously discovered by Prof. Marsh and himself in the Eocene of Wyoming, constituted points of affinity to the fauna of that period not previously suspected. He also observed that he had discovered some additional species of *Ruminantia* allied to the musk, and to the *Leptomeryx evansii*, which he named *Hypisodus minimus*, and *Hypertragulus calcaratus*, and *H. tricostatus*. The first was the least of the order, not exceeding a cat-squirrel in size. *Hypertragulus* differs from *Leptomeryx* in the isolation of the first premolar, as in the camels, and in the sectorial character of the penultimate premolar.—On circulatory movement in Vaucheria. Prof. Leidy made some remarks on the intracellular circulation of plants, as exemplified in the hairs of the Mullein, the leaf-cells of Vallisneria, &c. The moving streams of protoplasm he likened to amœboid movements, and expressed the opinion that they were of the same character. In the common alga, *Vaucheria*, the filaments of which consist of very long cells, comparable to those of Nitella or Chara, he had observed an apparent motion of the cell contents, which is somewhat peculiar and, at least, is not generally mentioned by writers. The wall of the cells is invested on the interior with a layer of tenacious protoplasm, containing the thinner liquid cell contents as usual. The parietal protoplasm is closely paved with green granules, and these appear very slowly but incessantly to change their position in relation with one another. The motion is so slow that it was a question for some time whether it did actually occur, but it appears sufficiently obvious if observed in relation with the lines of a micrometer, and its existence was confirmed by several friends whose attention was directed to it.

PARIS

Academy of Sciences, July 6.—M. Bertrand in the chair.—The following papers were read:—Presentation of a specimen of the photographs of an artificial transit of Venus obtained with the "photographic revolver," by M. J. Janssen.—Researches on solution, crystallisation, precipitation, and dilution, by M. Berthelot. This is a continuation of the author's important researches in thermo-chemistry. The thermal effects accompanying coagulation, the transformation of an amorphous into a crystalline substance, and the mixture of two saline liquids are now treated of. A differential method for measuring the specific heats of dilute solutions has been introduced.—On parasitism and contagion, by M. Ch. Robin.—M. Dumas made some remarks in reply to the foregoing paper.—On the spectrum of Coggia's comet, a letter from P. Secchi to the perpetual secretary. The author has observed that of the three carbon bands the green is the brightest, while in Tempel's comet the yellow was the brightest, a fact which proves that the gaseous combinations are not rigorously the same for all comets. It was further stated that at the beginning of the month only the band spectrum was visible, but now a general line of connection exists, forming a quasi-continuous spectrum through the centres of the bands. A drawing of the spectrum accompanied the paper.—On the photographic apparatus adopted by the Transit of Venus Commission: reclamation of priority; extract from a letter from Col. Laussedat to M. Dumas.—On the method of employing carbon disulphide in the treatment of vines attacked by *Phylloxera*, by M. Fouque.—In mathematical analysis:—On osculatory surfaces, by W. Spottiswoode.—Note on orthogonal surfaces, by M. E. Catalan, and Reply to the observations of M. Combescure, by M. l'Abbé Aoust.—M. Praznowski presented (through M. Janssen) a note on the helioscope. This instrument is designed by the author for diminishing the brilliancy of the sun's image by polarisation.—On the diffusion of light and the illumination of transparent bodies, by M. J. L. Soret. By examining quartz, amethyst, diamond, and other crystals, the author has concluded that the illumination of non-fluorescent transparent crystalline substances is always due to want of homogeneity.—On the formation of solar spots, by M. Tacchini. The author sees no confirmation of the cyclone theory of sun-spots in the detailed observations of the chromosphere made in Italy, America, and England. Some solar observations for June were also communicated, from which it appears that the sun was in a state of great activity during that month. On the 11th Mg. was reversed all round the sun's limb: on the 4th two double lines (4,924-5,018) were reversed on the western limb, and on the 11th they occupied nearly all that limb and encroached upon the eastern border. A great eruption took place on the 10th, when all the lines from *b* to 1,474 were seen reversed.—Researches on electric transmission through ligneous bodies, by M. Th. du Moncel. The author's experiments show that wood owes a considerable portion, if not all, its relative conductivity to moisture contained in the pores.—On the embryology of *Rhizocephalus*, by M. A. Giard. These animals constitute a Cirrhipedian group.—On the male accessory glands of some animals and on the physiological rôle of their product, by M. P. Hallez.—On the movement of the stamens of *Sparrmannia africana* L., of *Cistes* and of *Helianthemum*, by M. E. Heckel.—On the existence of diatoms in different geological formations, by M. l'Abbé Castracane.—Carboniferous limestone of the Pyrenees. Marble of Saint-Béat and of Mont (Haute Garonne), by M. F. Garrigou.—A neolithic flute, by E. Piette.—On a scab of the horse of intermittent character caused by an acarus, presenting the singular peculiarity of being psoric during winter, and simply parasitic during summer, by M. Mégnin.—Experimental researches on the action of water injected into the veins, from the point of view of pathogeny and uremy, by M. Picot.—Analyses of beers and malts, by M. Ch. Mène.—On the extraordinary hailstorm which fell in the department of Hérault during the night of June 27–28; extract from a letter from M. J. Gay to M. Ch. Sainte-Claire Deville. The loss of vines is stated to be valued at 50,000,000 francs.

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