THURSDAY, OCTOBER 1, 1874

HINTS ON MEDICAL STUDIES

FEW of those who to-day commence their medical education will be able fully to realise what would have been their position if they had done the same some fifty years or more ago, instead of now. After an apprenticeship of from three to five years to a country practitioner, during which time, at the expense of their general education, they would have been employed in dispensing medicines, and other less honourable duties, they would have entered on their medical studies, properly so called, possessing a certain empirical acquaintance with a few of the details of professional life, which might however, have been obtained in an infinitely shorter time after the principles of the subject had been mastered.

This state of things is fortunately past. The pupil now leaves school, having had a more liberal general training, conducted mostly during the time which used to be wasted in apprenticeship, and after being tested by a commencing examination in Latin, arithmetic, &c., he immediately begins his special studies at a recognised college and hospital. At the outset several questions respecting the direction that his work has to take, suggest themselves, which are only partially answered in the calendars of the different examining bodies, and on which there is considerable diversity of opinion amongst teachers and the profession generally. One of the most important of these refers to the question whether or not it is advisable to commence clinical work at once, or to wait until some knowledge of anatomy and physiology has been obtained. As the medical education consists of two parts, a theoretical and a practical, one conducted in the lecture-theatre and the dissecting-room, the other in the wards, out-patient department, and post-mortem theatre of the hospital: is it wise to pursue these two independent courses simultaneously, and if not, which should have the preference? This question is not difficult to answer, for it is evident that attendance in the wards of the hospital during the first medical session must very much resemble the justly disparaged period of apprenticeship. Like it, the knowledge acquired will be almost entirely empirical, and therefore so much the less useful; for the numerous facts which the student is learning from the classes he is attending at this early period, must for some time be so crudely associated in his mind that he will experience difficulty enough in retaining them there at all, let alone having to apply them to previously unexpected instances. We therefore would advise that the first winter session at least should be entirely devoted to lecture-work and the dissecting-room, and that the wards should not be systematically visited until the following summer. Then, even, as Materia Medica is not a winter subject, but little can be learnt with reference to treatment, except in surgery; experience in diagnosis must consequently be the only object kept in view. Afterwards, as much time as can be spared may be devoted to clinical work.

Another question which requires an answer refers to the number of subjects which ought to be embraced in the necessary course of study. Without wishing at present to enter into a discussion as to whether the vital force which is at work in the living body is anything *sui generis*, or only an elaboration of other well-known forces which are manifested by inorganic matter, there is no doubt that those physiological phenomena which are within the reach of complete human comprehension are all capable of being represented as problems of pure physics. Such being the case, the great importance to all thinking students of medicine, of a knowledge of the fundamental properties of matter, must be self-evident. Some may have had the opportunity of learning a little about mechanics, heat, light, and electricity at school, but most will be sadly ignorant on these subjects; and being so, when they have advanced sufficiently far in physiological and pathological investigation to appreciate the enormous fields for work which they open up, they will find no greater stumbling-block to their further progress than their imperfect training in the science of physics; it will act as a barrier against sound original work in all directions, and prevent many an able man from doing full justice to his mental capacities.

It is this unsoundness of the physical basis of physiology which maintains the considerable interval between physiologists and physicists; which makes it necessary to have physiological and physical laboratories as separate institutions instead of as different departments of the same establishment, and which allows flagrant physical inaccuracies in physiological investigations to be stated and restated under the approving sanction of those who ought to know better. What can horrify a pure physicist so much at the present state of physiological knowledge as, when he reads in a recently published work by one who is considered to be the British representative of the subject on which he treats, to learn that in the flight of birds the wings strike downwards and forwards; and in another work, by another prominent author, that the aortic valves, which correspond to the secondary valve of an ordinary pump, close *during* the contraction of the ventricles of the heart? Similarly, the phenomena of electrotonus, in the eyes of a physicist, have as little to do with the true nerve-current as the spark obtained from a Leyden jar has with that circulating in an ordinary electric telegraph cable. These instances, and many others which might be adduced, all point to the importance of a thorough knowledge of physics to the student of medicine.

Second only to physics, as a collateral part of medical education, is zoology. Many, however, would place botany next. No doubt a knowledge of botany is essential to a thorough comprehension of the details of Materia Medica; nevertheless, for the prosecution of work bearing on medicine proper, an acquaintance with the structure of animals is more important than that of plants. The latter may, most of it, be left to the pharmaceutical chemist, and be neglected by the physician. Very little is gained by the medical student when he learns that podophyllin is obtained from the rhizome of a ranunculaceous plant, or even that the natural order Solanaceæ has been divided up in a manner which physiological action justifies: but that the cæcum of the intestine is absent in many mammalia, and that it is of very much larger proportionate size in some than in man, must have an important bearing on our conception of the function of that organ. Many other similar instances might be given, all proving the importance of comparative anatomy in a medical point of view; and it is almost certain that before long that science will have a more prominent position in medical education than it at the present time possesses.

Those who have no other aspirations than to follow the routine practice of their profession immediately their few years of education are completed, will no doubt ignore the value of the extended curriculum we advocate: they imagine that it does not conduce to more accurate diagnosis or more correct treatment. This view is a short-sighted one, to say the least; for though the most able theorist may, by chance, be a bad practical physician or surgeon, yet the good he does by his higher work is insuperably greater in the long run than the immediate relief of individual cases. It is by the progress that is made by the profession in obtaining the mastery of disease that its position is maintained in society generally, and this progress is due much more to the theoretical chemist and physiologist than to the successful practitioner who simply follows the ordinary routine of his calling.

NOMENCLATURE OF DISEASES

Nomenclature of Diseases, prepared for the use of the Medical Officers of the United States Marine Hospital Service, by the Supervising Surgeon. (Washington: 1874).

THE preparation of this volume by Dr. Woodworth, supervising surgeon, has consisted in adopting, with some important omissions and unimportant transpositions, a literal transcript of the original "Nomenclature of Diseases" drawn up by a joint committee appointed by the Royal College of Physicians of London, of which Dr. Sibson was the editing secretary.

The original work received a modified sanction from the British Government, inasmuch as by the remarkable liberality of Mr. Lowe, then Chancellor of the Exchequer, money enough was provided to print off a large edition, and transmit a copy gratis to every member of the medical profession in Great Britain and Ireland. The further diffusion of the work in the United States by Dr. Woodworth is a thing for which the profession owes that gentleman hearty thanks. The work, indeed, seems to be more authoritative on that side of the Atlantic than on this; for the statistics of mortality for the ninth census of the United States were made up in accordance with its arrangement. This extension of a uniform nomenclature is itself, apart from the merits of the work, an evident great gain to science.

It is proposed to give the book a decennial revision; but while revision of some kind is periodically necessary, we do not anticipate that, after the work is thoroughly matured, it will be required above once in a generation,—three or four times in a century.

In the meantime, the book is in a somewhat imperfect state, many inaccuracies having been pointed out in a report upon it by the Edinburgh College of Physicians. The correction of such errors and the bringing of the work to the level of the present state of medical science will make it mature for the time being. But we hope that a new generation of medical men will find it necessary to revise it; not to correct common errors, but to adapt it to the then advanced state of medical science. We are doubtful as to the propriety of attempting work of this kind by a mixed committee. The committee should be of the only kind Dr. Chalmers could tolerate—a committee of one! only the one should have power to call in aid. The work of Linnæus or of Jussieu could not have been done by a committee.

A good nomenclature of diseases will inevitably represent the science of the day. According as science advances, so will the nomenclature and arrangement be more and more natural. The profession of medicine is to be congratulated on the felt want of a nomenclature temporarily fixed, and on the evidence this work affords of its generous ambition to rise above a mere nosology, to something like a natural pathological arrangement.

The wide diffusion of a book like this in the medical profession, besides its own immediate utility, is sure to exercise a very beneficial and much wanted scientific influence. The looseness of much professional writing will be diminished and precision encouraged. If medical terms are well defined, writers will naturally become more careful in their use of them. At present, medical writing is infested not only with ill-defined terms but indefinite description. How often do we see such phrases as "once or twice," when we should have "once" or "twice." We might give many examples of this looseness for which we tolerate no excuse; but there is a looseness arising from the imperfection of medical science which we must meantime tolerate. Good and precise definition of terms only becomes possible when we know the properties or peculiarities of what is to be defined, and medicine is as yet in too empirical a state for satisfactory definitions. That subdivision of it which is most advanced—pathological anatomy—illustrates well the growth of precision of terminology as advancing knowledge permits and demands it, definition and discovery going hand in hand.

The same branch of medicine affords the best illustration of an admirable struggle after a good nomenclature, but even for this branch there has not as yet arisen a Tournefort to produce, if not temporary unanimity, at least temporary union in regard to nomenclature—a deficiency which, however much to be deplored as a cause of confusion and error, implies blame to no one. If in morbid anatomy we have no established nomenclature, how can we expect it in the nosology? This department of medical nomenclature we regard as being meantime best left in what may be called its popular state, such names as scarlatina, erysipelas, cholera, thrush, being better than any that could be based on our present imperfect knowledge of these diseases. But although this may be so now, there is good reason to expect the day when good descriptive names will be found for all these diseases—names which will suggest to the instructed an epitome of what is known regarding them.

Such suggestive names cannot be, however, without a well-matured classification. At present there are several very natural but isolated classes of diseases which form good samples of what is wanted—zymotic diseases, parasitic diseases, mechanical injuries—but for the most part we have a disjointed catalogue rather than a classification. The attainment of a complete classification will be a great step, an index of progress and an aid to it; but it will be a structure, as we have already said, that advancing science will periodically overthrow. The ruin, however, will not be deplorable, because not only not irreparable, but certain to be succeeded by a new edifice which will in all probability be better and more useful than its predecessor. J. M. D.

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 Education of Women

In your excellent article (vol. x. p. 395) on this subject, you forcibly point out that custom and prejudice have established for boys and girls a curriculum of studies which seems to have but little reason to justify it. You particularly mention that whereas music is, in England, but rarely taught to boys, it is "almost compulsory on girls, whether they have the talent for it or not."

This monopoly of music for girls, supposing our system of education to be founded on reason, should imply, amongst other considerations, that females possess peculiar aptitudes for this branch of art, and that instructing them in it is more likely to produce favourable results in their case than in that of males. I do not say that this is the only probable justification for our practice, but it should certainly be one strong ground for it.

But how does the matter really stand? It is a most remarkable fact that in the highest walk of musical achievement, composition, women are positively nowhere. I believe I am safe in saying that not a single opera, or oratorio, for instance, the work of a woman, has ever maintained even brief popularity; nor has the sex furnished us with one representative worthy of being placed by the side of Bach, Handel, Mozart, Beethoven, Rossini, Mendelssohn, and a host of other great male composers who could be named.

In almost every other department of art and knowledge eminent women have been found—in literature, both prose and poetic, in mathematics, science, painting, sculpture, medicine; but not a solitary great female musical composer can be named.

I do not point out this fact for the purpose of disparaging the female intellect, of which I have the highest admiration, but for the purpose of reinforcing with it the arguments put forward by yourself and other friends of female education in favour of a revision of the subjects appropriated by unreasoning custom to the two sexes.

Considering, however, that the doctrine of chances might have been expected to give us at least one female musician of the highest order out of the myriads who devote a large portion of their existence to the cultivation of the art, the striking fact that it is not so is one well calculated to excite speculation. Is the power of producing new and acceptable music distinguishable in any way from other art power—that for instance of producing a fine painting, statue, or poem? There does seem to me to be this peculiarity belonging to music. The subjects of a painting, statue, or poem, may, and generally are, suggested by some event, person, tradition, or thing already existing. The suggestions of colour, form, light, and shade, furnished by nature, are endless, and capable of infinite diversification—they often, no doubt, act on the mind of the artist unconsciously—but, whether he is conscious of it or not, their influence is always at work—and though he produces something which we feel to be truly original, yet he is probably indebted for the first germ of the idea and for the greater part of the machinery by means of which it has been realised, to sources and materials previously existing, some of which have indeed generally left their traces on the work.

Can anything like this be said of music? What can have suggested some of the simple melodies to which we are never tired of listening, and which are so complete, so consistent, so satisfying, that we accept them almost like works of nature which we do not dream of altering? That there are associations of ideas between musical sounds and visible things, and even moral sentiments, may be true, but such relations must be vagueness and mistiness itself, compared with the relations on which other arts are dependent. So slight, so remote, so intangible are the sources of original music, that it has always seemed to me that the faculty of musical composition of the highest order approaches more nearly to inspiration than any other faculty with which mankind is endowed.

How can the apparent absence of this faculty in women be explained? ALEX. STRANGE

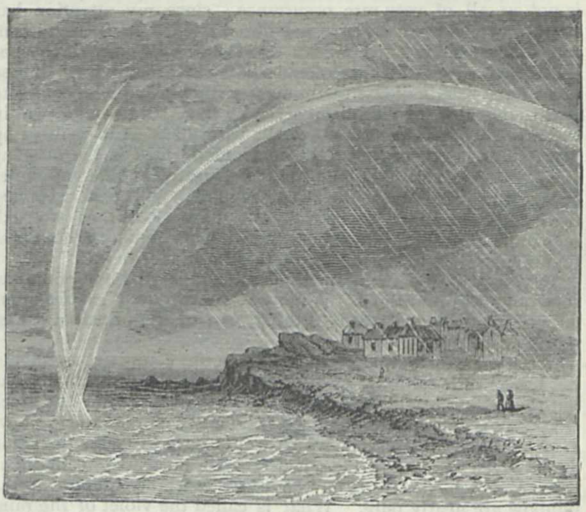
London, Sept. 22

Double Rainbow

On the 11th, at 5.40 P.M., this comparatively rare phenomenon was well seen here by the crowd assembled at the Ladies' Golf Match. The accompanying sketch, by T. Hodge, Esq., gives a thoroughly artistic view of the scene.

Unfortunately the estuary of the Eden, whose quiet water furnished the reflected sunlight, is considerably north of the observer's station. Hence the necessary incompleteness of the second bow. I cannot learn whether any spectator was fortunate enough to observe the phenomenon from a point a mile or two north, whence it would probably have been seen entire.

As seen from stations to the eastward of St. Andrews, the second bow, there due to light reflected from the rougher water of the bay, was considerably broader than the first; so much so



at the upper end of the visible portion as to give, even to intelligent spectators, the impression that it was convex instead of concave to the point opposite the reflected sun.

It was not possible to ascertain whether the light of the portions of the two bows visible below the horizon was that coming from the rain-drops directly, or that subsequently reflected from the sea; though (*pace* Dr. Tyndall) probably the latter was at least a considerable agent. P. G. TAIT

St. Andrews, N.B., Sept. 15

P.S. In my note on "Bright Meteors" (NATURE, vol. x. 305) I find I have inadvertently written Saturday in place of Sunday. Perhaps, with this correction, Mr. Waller may be able to identify both meteors in a satisfactory manner.

This is the phenomenon observed by Dr. Halley, Aug. 6, 1698, at Chester. The second bow was formed by the sun's light reflected from the river Dee. See "Brewster's Optics," p. 380.

Of the parts of the two bows below the horizon, the outer is a continuation of the primary bow, and is formed principally by direct sunlight striking the drops between the observer and the sea and reflected in the ordinary manner.

It may derive a slight increase of brightness from light first reflected at the sea, then by rain-drops, and lastly by the sea again. The inner part is produced by one reflection from the sea and one reflection from rain-drops. The brightness will be the same whichever reflection comes first, provided the smooth sea, the rain-drops, and the sunlight are present.

J. CLERK-MAXWELL

Curious Rainbow

I do not see that the rainbow described by Mr. Swettenham (NATURE, vol. x. p. 398) was different from an ordinary rainbow of moderate brightness, except in there being a slight interval between the two series of colours, which generally blend into one another. The fainter series are attributed to interference. In bright rainbows there are three, if not four, series of colours, at least in the upper part of the arch, where the colours are always the most distinct, probably owing to the rain-drops being smaller high up, and therefore more perfectly globular. It may not be generally known that a rainbow may be seen much more perfectly in a single drop of dew, by placing the eye close to it, than in rain, and then no less than ten or twelve series of colours may be seen; and in the irregular dew-drops (as also in hoar-frost) a great and very beautiful variety of bows and spectra can be seen. T. W. BACKHOUSE

Sunderland, Sept 23

I SHOULD like to say a few words regarding Mr. Swettenham's letter (NATURE, vol. x. p. 398). The mathematical theory of the rainbow has been worked out pretty completely. We must not look for it, however, in text-books, which generally give a very unsatisfactory account of the rainbow, but in the original memoirs, which sometimes are very difficult to find.

The appearance of coloured bands inside the primary rainbow is not at all of very rare occurrence; since my attention has been drawn to them by a casual observation, I have seen them repeatedly. Only a few weeks ago I saw distinctly three concentric bows, with all the colours inside the primary bow. These bows have been called supernumerary rainbows. The complete mathematical theory has been given by the Astronomer Royal in the *Philosophical Magazine*, and the theory has been verified by Mr. Miller. The cause of these coloured rings is the interference of two rays of light entering the rain-drop at different angles of incidence, but having the same deviation, and therefore leaving the rain-drop parallel to each other. It is clear that two such rays must exist for all deviations from the maximum to the deviation of ray of light having an angle of incidence of 90°.

In text-books no mention is ever made of these supernumerary rainbows, and this is the more to be regretted as the interference mentioned above is, I think, one of the principal causes of its formation.

Were the explanation given in text-books complete, we should not have in the rainbow such pure colours as we actually see, but the yellow would contain a great deal of red, and the green would be contaminated by a great quantity of red and yellow. As it is, however, the red, which would have the same deviation as the green and yellow rays, is destroyed, or nearly so, by interference, which, therefore, is the cause that the colours of the rainbow are nearly pure. What is called the violet of the rainbow is generally the violet mixed with the red of the next supernumerary rainbow. This is not the only instance that text-books contain incomplete accounts of phenomena which have been satisfactorily explained. ARTHUR SCHUSTER

Sunnyside, Upper Avenue Road

Mist Bows

ON Sept. 14 I was driving from the Lizard just after sunrise with Mr. Lugg of Manaccan. A thick mist covered the fields and moorland. The tops of the farm buildings and corn stacks and the church towers were visible above the sea of mist which, matted on the ground, gave the entire country the appearance of being covered with snow. About 6.30 A.M. the sun was bright on our right hand, and on the left we saw a halo of prismatic colours forming a distinct circle of rainbow at a little distance from and encircling the shadows of our heads, and only broken where the shadows of our bodies interposed. This appearance lasted for ten minutes, and our shadows with their attendant bow showed brightly against the mist background as we passed hedges and fields, and kept pace with us like "the mist raised from the plashy earth" by the hare in Wordsworth's poem,

"That, glittering in the sun,
Runs with her all the way wherever she doth run."

We afterwards opened a valley terminating in an extensive moor, when the mist appeared as a sea of prismatic colour extending to the horizon. About 7 A.M. we saw a perfect bow free from any prismatic colour, both ends of which terminated in the field immediately to our left.

My companion, who is constantly driving about this district in early morning, says he never before saw similar phenomena.

Lizard Signal Station, Sept. 16 HOWARD FOX

Carnivorous Plants—how to be obtained

IT is not unlikely that there may be a great demand for plants of the genus Drosera, and as I am in a neighbourhood where the supply of the *D. rotundifolia* and *D. intermedia* is inexhaustible, I shall be glad to send, through the post, plants of the same to any who are desirous of investigating their carnivorous habits; but to meet the necessary expenses of collecting and postage, six penny stamps must be enclosed in the application for each dozen plants. The applications of dealers in plants will not be attended to.

The *D. intermedia* is far more abundant than the *D. rotundifolia*, and will answer the purpose of investigators quite as well. A few words about the method of growth of these may not be out of place. Pure peat well soaked with water suits either kind, but while the *D. intermedia* flourishes with its roots beneath the surface of the water, *D. rotundifolia* grows best when it is from 3 in. to 4 in. above the surface; now and then it happens that it is found with its roots in the water, and then the hairs on the stalks of the leaves, which constitute one of the distinguishing features between these species, are much diminished, both in number and length.

The Liverpool naturalists will find a large supply of the *D. rotundifolia* on Oxton Common, and there they are most abundant in the corner nearest to Noctorum Farm. Thurstaston Hill is another locality in the same neighbourhood where this plant grows.

The *Pinguicula lusitanica* is not uncommon in the bogs of the New Forest, but I cannot promise specimens of this plant with the same certainty as I can those of the Droseræ. Applications for plants had better have the word *Drosera* written on the envelope, to prevent the delay which would arise from such letters being forwarded to me when away from the New Forest.

Bisterne Close, Burley, Hants G. H. HOPKINS

[Both species are moderately abundant, though small, in a peat-bog near Burnham Beeches, Bucks, about four miles from Slough.—ED.]

Automatism of Animals

PROF. HUXLEY'S most interesting address published in NATURE, vol. x. p. 362, seems to me to involve some difficulty, which I take the liberty to state, though well aware that I am stepping on slippery ground. I allude to this passage:—"Suppose I had a frog placed in my hand, and that I could make it, by turning my hand, perform this balancing movement. If the frog were a philosopher he might reason thus: 'I feel myself uncomfortable and slipping, and feeling myself uncomfortable I put my legs out to save myself. Knowing that I shall tumble if I do not put them further, I put them further still, and my volition brings about all these beautiful adjustments which result in my sitting safely.' But if the frog so reasoned he would be entirely mistaken, for the frog does the thing just as well when he has no reason, no sensation, no possibility of thought of any kind."

Now, does it unavoidably follow from the latter fact that this philosophising frog would be *entirely* mistaken? What I should venture to object is simply this:—Experiment shows, indeed, that very delicate combinations of muscular actions (as in swimming) are brought about by impressions upon the sensory nerves, even when, after ablation of the brain, there can be no longer any consciousness. But have not those combinations originally arisen during undisturbed consciousness, and therefore, perhaps, under the influence of consciousness, inscrutable as the relation of consciousness to corporeal phenomena is acknowledged to be? And even if the experiments alluded to should succeed with animal individuals which, before vivisection, never had executed the movements in question (and I was once assured by a distinguished physiologist that similar experiments do really succeed with rabbits deprived of part of brain soon after birth), yet those adjustments may be rather considered with regard to the great principle of inheritance, as it has been applied to instincts by Mr. Darwin and Mr. Spencer, and alluded to in Prof. Tyndall's address. Though now performed by animals without possibility of sensation and thought, those movements were adjusted to each other, and to impressions on sensory nerves in these animals' ancestors while in possession of consciousness.

Surely such questions will ever remain doubtful; yet I think it not unbecoming to state a view of them which seems to me to be in accordance with the present direction of biological theories. I. D. WETTERHAN

Frankfort-on-the-Maine, Sept. 20

Photographic Irradiation

I HOPE you will allow me space to correct a slight misunderstanding which has got into the present discussion on photographic irradiation. Mr. Crofts (NATURE, vol. x. p. 245) places my views in opposition to those of Lord Lindsay and Mr. Ranyard. Mr. Stillman (NATURE, vol. x. p. 381), who has given us such valuable information on the molecular condition of different preparations of collodion, also takes the same view. Now in reality Lord Lindsay's and Mr. Ranyard's views are not opposed to mine. I have simply attempted to prove that molecular reflection was *a cause* of photographic irradiation, not that it was *the only cause*, as I quite agree with Lord Lindsay and Mr. Ranyard, that the imperfections of the lens are also causes of photographic irradiation, and in NATURE, vol. x. p. 185, I pointed out one form of irradiation due to the lens. But the imperfection of the lens which is most fatal is that pointed out by Lord Lindsay and Mr. Ranyard, namely, the inability of the lens to bring all the rays to a focus, whether this results from the imperfections of the outside portion of the lens, or from imperfect achromatic * correction. No maker of lenses will tell you that any lens, far less that every lens which he puts out, is perfectly corrected for dispersion. Working with such an instrument, it is very clear that if we only allow an exposure sufficient to give an image on the part of the collodion where the great proportion of the rays are focused, then the photographic impression will give very nearly the true boundary line. But suppose we allow more light to pass through the lens, either by turning the camera to a brighter light or by giving a longer exposure, then it is clear that the unfocused rays which gave no impression when the exposure was short, will now impress themselves on the collodion, and thus the photographic impression will be extended beyond the true boundary line.

That there should be difference of results in experiments on photographic irradiation is quite to be expected, as there are so many variables in the experiments. The light, temperature, and condition of the collodion are all constantly changing, and the conditions under which the experimenters work, and the apparatus and chemicals used, are different for each experimenter; different results may therefore be expected. If the experimenter use a good lens, and employ only the central portion of it, the imperfection due to the lens may be small in quantity. But if his lens is imperfectly shaped and badly corrected for dispersion, and he uses the full aperture, the result will be very different. Again, if the experimenter work with different collodions, Mr. Stillman has shown that, altogether independent of the lens, a very slight change in the preparation of the collodion greatly alters the amount of irradiation. So far as I can at present judge, the imperfections of the lens and molecular reflection are not opponents, but allied enemies, which we must meet on the same field.

JOHN AITKEN

Darroch, Falkirk, N.B.

Can Land-crabs Live under Water?

WHEN in Atchin, in Sumatra, during the second Dutch expedition, it occurred to me to put to experimental test a statement which I thought I had seen in some book or other—this book turns out to be Prof. Marshall's work on "Physiology"—to the effect that land-crabs are drowned when kept immersed in water.

On one occasion I kept one of these crabs under water for two hours, after which time it was as lively as ever; and on another day a larger specimen was kept submerged for exactly four hours, after the lapse of which time it was somewhat subdued, but by no means moribund.

Unfortunately the duration of my experiments was always limited by the necessities of ablution, as our largest receptacle for fluids was a small-sized Huntley and Palmer's biscuit-tin, which served as our only washing apparatus, as well as the laboratory—eventually a very leaky one—for my experiments, for a period of four months spent under an equatorial sun.

New University Club, Sept. 22 J. C. GALTON

* We here require some new word, or we must greatly extend our conception of achromatism, as we have here to deal with rays far beyond the limits of the sensitiveness of the eye; and the word achromatic, as applied to lenses for chemical purposes, is somewhat misleading. I may here offer two suggestions as to how the imperfect power of the lens to bring all the different rays to a focus may be partially corrected:—(1) By using a collodion which is as nearly as possible only sensitive to those rays which the lens can bring to a focus; or (2) by providing each lens used for making accurate observations with a screen, which shall stop back all the rays beyond the limits which the lens can focus.

Salivary Glands of Cockroach

I SEE in NATURE, vol. x. p. 381, a letter on the salivary glands of the cockroach, by Dr. W. Ainslie Hollis, in which he remarks:—

"As far as my experience carried me, the sacculi, the supposed reservoirs of the saliva, never contained naturally any liquid whatever, but on opening the thorax were invariably found to be collapsed and empty."

A few days ago I was observing some of these creatures. I examined several shortly after they were caught; in these the sacculi were empty, but others which I had kept alive in a cup with only a few drops of water for a day or two, had invariably the sacculi distended with liquid.

I will not attempt to explain these facts, but leave that to others more capable than myself.

CHAS. WORKMAN

Belfast, Sept. 21

THE AUSTRIAN POLAR EXPEDITION

THE Vienna correspondent of the *Times* supplies some interesting details concerning this important expedition. Events have proved that there has not been an expedition better fitted out, as to ship, stores, or crew, than that in which this North Pole Expedition left Bremerhaven on June 13, 1872.

As to the crew of twenty-four men, it was composed of three naval officers, Lieutenants Weyprecht and Brosch and Ensign Orel; two engineers, and fifteen picked Dalmatian sailors; Lieut. Payer, of the Jägers, an Alpine Club man, with two Tyrolese mountaineers; Haller and Kletz, and the Hungarian Képesy as surgeon. It was thus calculated for land work not less than sea work, and events proved that the company had been well sorted.

The object of the expedition being to find a north-easterly passage towards the coast of Siberia, the expedition having arrived at Tromsoe, and having taken on board Capt. Carlsen as harpooner and ice-master, started on the 14th of July for the sea and the coast of Novaya Zemlya. At Novaya Zemlya they met the Norwegian yacht *Jsbjörn*, in which Count Wilczek and Baron Sternberg, two of the chief promoters of the expedition, had come over from Spitzbergen to establish a store for them near Cape Nassau. They were for two years the last human beings they saw. The stores being laid in a cleft of the rocks inaccessible to the Polar bears, and the state of the ice looking more promising, the ships parted company on the 21st of August, the *Tegethoff* going north, the *Jsbjörn* south. The hope proved to be fallacious long before evening. The *Tegethoff* was icebound, and never was got out again. The temperature sank, copious snowfalls cemented the loose ice-fields, and the *Tegethoff* was surrounded by a solid mass of ice.

In this precarious state the ship lay for five months, the ice freezing together and bursting in turn, and so exposing it perpetually to fresh pressure. All was prepared for leaving the ship. The stores were brought on deck and a portion placed on the ice. This was the most trying time of the whole. Every moment the alarm was sounded and the signal given for leaving the ship. It was sufficient to wear out the strongest. In spite of this, meteorological and other observations were carried on. The strain on the mind told on the state of health in spite of all precautions, and scurvy and pulmonary affections set in.

All this time the ship was being driven in a north-easterly direction until, towards the end of January, 1873, 73 W. long. and 79 lat. were reached on February 25. The sun appeared again after five months on the horizon, and on the 25th the pressure of ice ceased. A massive wall had been formed round the ship, protecting it from further injury. The drifting was now to the north-west. Milder weather having set in, the hope revived of setting the ship free, and for five months the work went on. By dint of boring and blasting the fore part of the ship was made free, but to free the aft proved impossible, ice of 30 ft. thickness lying underneath.

Disheartened, the expedition had almost resigned itself to have to pass another winter in the same position, when, on the 31st of August, high land was seen in the north, some fourteen nautical miles off. The feeling at first of great joy at the unexpected discovery became soon a torture. To be so close and not to be able to get to that unknown land. At last, towards the end of October, the ship drifted to about three miles off one of the islands which lay before the main land, and there the ship froze in at the beginning of November, and lies still in 79° 51′ N. lat. and 58° 36′ W. long. Here the winter of 1873-74 was passed in comparative quiet.

During the time a series of highly interesting astronomical, meteorological, and magnetical observations were made. The Northern Lights were very numerous and magnificent—white, red, and green, with crowns, bands, and rays of great size and brilliancy. The needle was so disturbed that oscillation became the rule and steadiness the exception. The cold was more intense than the year before, there being 37° Réaumur below zero on the ship. But the supply of fresh bear's meat and the absence of that strain on the mind produced by constant danger kept the crew in better health. The reappearance of the sun on the 24th of February did the rest for all except Krisch, the engineer, who died of consumption on the 17th of March, and was buried in the newly discovered land, between two basalt columns; for the explorations had already begun.

A first expedition of Payer, the two Tyrolese, four sailors, and the only three dogs remaining started for the mainland, went up the promontories named Tegethoff and M'Clintock, 2,500 ft. high, and up the Nordenskjold Fjord, bordered by the large Souklar glacier. It was still very cold, 40° Réaumur. All was still white with snow and hoar-frost, making the symmetrical rock columns look like candied sugar.

The second expedition of thirty days started on the 24th of March. The temperature had risen, but snow-drifts, wet, and the breaking up of ice made the journey still more dangerous. Of course, before getting the map it will be impossible to form a clear image of the configuration of the country. The atmosphere over the ice being hazy, the only way for making observations was by going to the heights, and by these means a succession of points was established—Cape Koldewey, 80° 15′; Cape Frankfurt, 80° 25′; Cape Ritter, 80° 45′; Cape Kane, 81° 10′; and Cape Fligely, 82° 5′, all on the Austria Sound. The diminished stores and the short available time necessitated forced marches, so one-half of the party was left under a rocky eminence in 81° 38′, and Payer, Lieut. Orel, the sailor Zaninovich, and the three dogs started to cross Crown Prince Rudolf's Land. Undeterred by a dangerous accident, the expedition went on by a roundabout way to the coast, and along it again northward. The progress became more and more difficult and dangerous; it was all fresh ice, often not more than a few inches thick. From Cape Fligely, the most northerly point touched, another elevated point, named Cape Wien, was sighted in 83°, the most northerly point of the known earth. Then the journey back again was more dangerous than the advance, but on the 25th of April the ship was seen on the spot where it had been left.

After a few days' rest, very much wanted, a third expedition was made, again to the west—like the first—when a high mountain, Cape Brünn, 40 miles from the ship, opened out a view over the mountainous country, with the Humboldt Peak, about 5,000 ft. high, as its culminating point.

Already, in March, a council had been held, and the decision had been come to to abandon the ship and to try to make their way back on sledges and boats. On the 20th of May the colours were nailed to the masts of the ship, and the expedition started with three boats and as many large sledges. The exertions proved almost too much. The journey had to be made five times over, three times tugging at boats and sledges, then twice back again. The continual south wind driving the ice northward seemed to make all efforts to get south useless, and after eight months' toil it seemed as if nothing remained but to return to the ship and pass there another winter. In the second half of July, however, north winds set in with rain, loosening the ice, and breaking it up, until on the 13th of August the expedition got into free water. It was in the unusually high latitude of 77° 40′. Had it not been for this exceptionally favourable state of the ice, the impression is that the expedition would not have been able to return. Now there was the pulling for the land. The crew and officers, divided into two watches, took it in turn day and night, so that forty miles' progress was made daily. On the second day the mountain of Nowaja Saulja was sighted. There were still provisions for a fortnight. A portion was left on shore, and then the southern bays were searched for Russian fishermen. None were found at the Barents Islands; bad weather set in, the sea ran high, all were wet through and unable to pull. It was already settled that the White Sea was to be made if no ship was found up to the 28th. However, on the 29th, two fishermen were sighted in a boat belonging to the schooner *Nicolay*, which brought the expedition to Vardöe on the 2nd of September.

The new land, as far as discovered, is about the size of Spitzbergen, and consists of several large masses intersected by fjords and surrounded by islands. A large passage called the Austria Sound separates these masses and forks under 82° north latitude into a north-easterly arm, which could be followed up to Cape Pest in the furthest north. The mountains are dolomitic. Their middle elevation is from 2,000 to 3,000 feet, only towards the south they may rise up to 5,000. All the depressions between the summits are occupied by glaciers of gigantic size, as they only occur in arctic regions. The vegetation is much poorer than that of Greenland, Spitzbergen, or Novaya Zemlya, and in the south, except for Polar bears, it is devoid of animal life too. Several attempts were made to pass through the country, but they were found impossible, mountains barred the road, so progress was tried along the coast line, and the more the explorers penetrated north by west the more the temperature rose, and the coasts of Crown Prince Rudolf Land were found to be tenanted by myriads of birds, elks, &c., traces of bears, foxes, and hares appeared, and seals lay on the ice. In spite of the treacherous nature of the road, it was continued to 82° 5′, where, at Cape Fligely, a wide expanse of water only covered with ice of recent formation was seen. In spite of this the explorers think the open Polar sea a delusion. Without raising a theory about the possible connection of this new land with Gillis Land in the south-west, the opinion is that it bears out up to a certain point Peterman's assumption of an inner arctic archipelago.

The fact of the expedition having found *hares* in the newly discovered land seems significant of a channel, not invariably frozen in winter, between Franz-Joseph Land and Spitzbergen, since hares do not occur in the latter.

In Norway the members of the expedition were received with the greatest enthusiasm, at Hamburg they were welcomed like bringers of good tidings, and on their entry into Vienna they could not have received a greater ovation had they been the remnant of a conquering army. All this they have richly merited, and there can be no doubt that Lieutenants Payer and Weyprecht have won for themselves a place in the first rank of arctic explorers.

A second Austrian Arctic Exploring Expedition is being prepared at Vienna to start next summer. One half of the expedition will seek to advance to the north, under Lieut. Payer, by way of East Greenland, and the other half, under Count Wilczek, will proceed *viâ* Siberia. The object of the expedition is to ascertain if the newly-discovered Franz-Joseph Land is a continent or an island.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE twenty-third meeting of this Association, which commenced at Hartford, under the presidency of Dr. J. L. Le Conte, on Aug. 12, seems to have been a successful one. Apart from the regular growth in prosperity which is exhibited every year, there was the unusual accession of the chemists, who have resolved to make their science strongly represented, and there was the excitement and interest which attended an important change in the constitution of the Association. The nature of the change we have already indicated (vol. x. p. 382). There was an unusually large attendance of the most eminent American representatives of science. The Association meets at Detroit next year on the second Wednesday of August.

The president's address consisted chiefly of allusions to some of the principal scientific events of the year, and of a summary of the matters to come before the Association. At a later period of the meeting the retiring president gave his address, in which he reviewed the progress of scientific instruments and methods. We can only refer very briefly to some of the more important papers read.

In a paper *On the Periodicity of the Rainfall in the United States in Relation to the Periodicity of the Solar Spots*, by Prof. John Brocklesby, the author concludes from his investigations that in the United States there is a connection existing between rainfalls and variations in the sun-spot area; the rainfall rising above the mean when the sun-spot area is in excess and falling below it when it is deficient.

Differential Measurements of Solar Temperature, by Prof. S. P. Langley of Pittsburgh, Pa. After stating the aims of the Alleghany Observatory at Pittsburgh, and giving details of the work now carried on there, consisting largely of observations and photographs of the sun, Prof. Langley said that there is a very wide variation in both the heat and light, and probably also in the actinic force of different parts of the sun. The difference is due principally, but not wholly, to differences in atmospheric absorption. Prof. Henry observed that the image of a sun-spot is colder than the photosphere surrounding it. Secchi has shown that the heat of the sun diminishes as we approach its edge, and he thinks that there is a different temperature at the sun's equator and the poles. Prof. Langley gave details of his own experiments with a thermopile upon these points. He finds that the observation of Prof. Henry is correct. But comparing the image of the spot with the photosphere immediately surrounding it, he finds that the image of a spot not far from the centre is uniformly warmer than that of the edge. To get the full significance of this observation we must consider that the image of the same spot is at the same time darker and colder than the photosphere near the centre, and darker and warmer than the photosphere near the edge. A series of measurements of the heat from the centre to the edge were made.

It does not appear as the result of these experiments that there is so great a selective absorption of heat in the lower regions of the sun's atmosphere, that when rays come from the edge of the disc and pass through a greater proportional thickness of his atmosphere, the heat is filtered from them and the light allowed to go through. We find that the heat falls away so very rapidly towards the edge as to indicate a much greater thinness of the solar chromosphere than has been hitherto admitted. We appear to have been led to the conclusion that there is a local obscuration over the spot very remarkable both in degree and kind. Prof. Langley exhibited a photograph of a sun-spot that looked, he said, like a sketch of a crystallising substance; when, however, we consider the enormous areas involved, we find the analogies of crystallisation wholly fail us, and we may more probably account for the facts by a hypothesis of cyclonic action. He concluded by pointing out the great value of these studies in connection with investigations in terrestrial meteorology.

Distribution of the Poles of Nebulæ, by Prof. Cleveland Abbe, of Washington. The general problem attacked in the present paper is the question whether there are planes that have a definite relation to nebulæ.

It may in general be stated that the positions of planes of rotation among the nebulæ do not show any such uniformity as is the case with the solar system: on the contrary, they are at all possible angles with each other. But there is this remarkable feature: that their nodes cluster about a point in R.A. 12h. 45m. and declination 60° N., that point being the North Pole of the plane near which lie the majority of the so-called axes of rotation.

Cave Fauna of the Middle States, by Prof. A. S. Packard, jun., of Salem, Mass.—For about a month during the last part of April and early in May last, Prof. Packard was engaged with Mr. T. G. Sanborn in exploring the caves of Kentucky under the auspices of the Geological Survey of that State, Prof. Shaler accompanying Prof. Packard. They first examined the Mammoth Cave, and doubled the number of animals known to exist therein and in others adjoining. An exploration, with Prof. Shaler, of the Carter Caves in Grayson County, Ky., also revealed a rich fauna composed of twenty species. Prof. Packard also examined Wyandotte Cave alone, and found a wingless Procus and two species of Thysanura new to the cave. Several caves within sixteen miles of New Albany, Ind., at Bradford, were examined. Finally, a careful examination of Weyer's Cave, in Virginia, and the adjoining Cave of the Fountains revealed a fauna containing some twenty species, no life having been previously reported from those caves.

These results show a great uniformity in the distribution of life—more than would at first be expected, though these caves lie in a faunal region nearly identical as regards the external world, and the temperature of the caves is very constant. Still some notable differences occurred.

Change by Gradual Modification not the Universal Law, by Thomas Meehan, of Germantown, Penn.—After adducing many instances in support of the theory that new forms are often generated by "leaps," Mr. Meehan concludes with the following propositions:—1. Morphological changes in individual plants are not always by gradual modifications. 2. Variations from specific forms follow the same law. 3. Variations are often sudden and also of such decided character as to seem generic. 4. These sudden formations perpetuate themselves similarly in all respects to forms springing from gradual modifications. 5. Variations of similar character occur in widely separated localities. 6. Variations occur in communities of plants simultaneously by causes affecting nutrition, and perhaps by other causes. Mr. Meehan argues from these premises that new and widely distinct species may be suddenly evolved from pre-existing forms without the intervention of connecting links.

This paper provoked considerable discussion. Prof. Morse said that the impression seemed to prevail among a great many that Prof. Meehan's paper was an argument against Darwinism, while in reality, in whatever sense you look at it, it was a corroboration of the theory of evolution. Prof. C. V. Riley insisted that most of the circumstances cited by Prof. Meehan found their parallels in what were generally known to zoologists as well as botanists as "sports" or even "monstrosities," and that Mr. Darwin himself had instanced some of the most interesting cases.

Prof. Asa Gray remarked that he only wished to state in respect to variations occurring abruptly as they did, that those certainly were not the kind of things which Mr. Darwin would have regarded as in any way interfering with his view, and he did not think Mr. Meehan had rightly comprehended the statement to which he had called attention. "I think (pursued Prof. Gray) that the statement, whatever it is, taken in connection with the remark which Mr. Riley made, and which Mr. Darwin a good deal insists upon, viz., that he does not look to monstrosities for the introduction of new forms, because the monstrosities may be expected to be taken out of relation to the surrounding circumstances, and that it is only those modifications which are in relation to surroundiug and changing circumstances that can be utilised and turned to account—is not to be found fault with. Mr. Darwin distinctly notes that monstrosities may be hereditary, and so may be supposed even to be continued if they were sufficient in relation to surrounding circumstances. So, if Mr. Darwin readily takes into his view changes like that which everyone calls monstrosities, he may readily be expected not to regard it as any infringement upon the maxim that varieties should come into existence quite abruptly with considerable differences. I think it is true that varieties are apt to arise in that way with very considerable differences, and so true that those surely are not the kind of things to which Mr. Darwin looks as difficulties to overcome, but as stepping-stones in his way."

Glacial Phenomena in the Sierra Nevada, by Prof. John Muir, of Oakland, Cal.—The studies of Prof. Muir referred particularly to that portion of the Sierra which is embraced between lat. 36° 30' and 39°, which measures about 200 miles in length by about 60 in width, and attains an elevation along the axis from 8,600 ft. to nearly 15,000 ft. above the sea. All the individual mountains distributed over this vast area, of whatever kind, have been brought into relief during the glacial epoch by the direct mechanical action of the ice-sheet and the glaciers into which it afterwards separated. The chief phenomena presented are :—(1) scratched and polished surfaces, (2) moraines, (3) moutonned rock-forms, and sculpture in general, as seen in valleys, ridges, lake basins, and separate mountains.

The paper goes on to describe the lofty mountains distributed along the summit of the portion of the Sierra under consideration, which are almost wholly unexplored—Mounts Dana, Lyell, Whitney, and Tyndall. The Pinnacles, which are the smallest of the summit mountainets, are described in an interesting way, the author concluding that instead of each being formed by special upheaval, or supposing that the chasms which separate them were made by subsidence, they were formed by the removal of the materials which once filled the intervening chasms. The same truth applies to the larger peaks, and the author concludes this branch of his subject by saying that they are all residual masses of the once solid wave of the entire range, and all that would be required to obliterate their distinctive character would be the restoration of the materials which have been carried away.

The next inquiry is, what has become of this material, not the millionth part of which can now be seen? and the author answers himself with the statement that glaciers were the transporting agents, and that in forming the basins and valleys in which they flowed, they carved out the summit peaks. This is so important a proposition as to demand careful attention to its proof. This proof is brought forward in detail. Subsequently, granting this proposition to be true from the proof, the author is obliged to go on to show what force or forces have sharpened the crests, which bear no trace of glacial action, and which were probably always above its reach. Next is considered the formation of special groups of mountains, and the geological effects of shadows—in prolonging and intensifying the actions of portions of glaciers, as shown in moraines, lake basins, and in the difference in form and sculpture between the north and south sides of valleys and mountains; especially as to their effects in the segregation of mountain masses. Also as to the effect of physical structure upon surface features, and the cause of the absence of well-marked individuality in summit mountains.

Prof. F. W. Clarke, of the University of Cincinnati, read a paper *On the Molecular Volume of Water of Crystallisation*. He stated that, to the chemist, it is important to get at some distinguishing character between water of crystallisation and true water of hydration. This character may be found by a study of the molecular volumes of various hydrated compounds. If we determine the molecular volume of frozen water, that is ice, we shall find it to be 19·6. If that water unites to form a hydrate or a crystalline salt, contraction ensues, and by studying that contraction we get at curious results. In the case of water of crystallisation, Prof. Clarke has studied over thirty salts, and in every case the molecular volume of the water is about 14. With water of hydration no such regularity is found. Evidently, then, when water unites with an anhydrous salt from water of crystallisation, all the condensation which occurs is on the part of the water, the volume of the molecule of the salt itself remaining unchanged.

Prof. Clarke also read a paper *On the Molecular Heat of Similar Compounds*. Prof. Clarke said that it is commonly thought that similar compounds have equal molecular heat. This is only approximately true. In comparing about twenty series of similar compounds, Prof. Clarke finds that the molecular heat increases slightly with the molecular weight, though in a very different ratio. In comparing all the extant determinations of specific heat, he has found only two or three exceptions to this rule, and even they were doubtful.

Prof. R. E. Rogers, of the University of Pennsylvania, read a *Notice of Prof. A. K. Eaton's new Compound One-prism Spectroscope*. The instrument is the invention of a Brooklyn chemist, and is by himself named "a direct-vision spectroscope." It consists of a thick plate of glass with parallel sides, united to one of the faces of an ordinary bisulphide of carbon prism, or a prism of dense flint-glass. According to the amount of dispersion desired, the light is made to enter either on the end of the glass plate or on the opposite face of the bisulphide prism. The results obtained from this instrument are as follows :—The dispersion of this compound prism is nearly four times greater than that of the ordinary 60° prism. The mean emergent ray is practically parallel to the incident ray. It does not deflect the ray from its original path. Many Frauenhofer lines are visible by this prism with the naked eye, while with the observing telescope all the prominent lines are clearly reversed, without the use of the slit or collimator, by merely throwing a strong beam of light by means of a mirror.

Dr. J. H. Mellichamp, of Bluffton, S.C., gave an account of some recent observations at Bluffton upon the *Sarracenia variolaris*, which abounds in that locality. This species of the pitcher plant has an elongated, conical, erect leaf, with a broad lamina curved over the opening, and a wide longitudinal wing upon one side the whole length of the tube. The upper portion is veined with purple, the intervening spaces being white and diaphanous. Dr. Mellichamp establishes the following points :—The base of the tube secretes a watery fluid, which is not sweet nor odorous, but which proves quickly fatal to all insects that fall into it. The whole inner surface is covered with very minute prickles, perfectly smooth and pointed downward, which render it impossible for an insect to ascend by walking, even when the leaf is laid nearly horizontal. Within the somewhat dilated rim of the tube there is a band half an inch in width, dotted with a sweet secretion, attractive to insects, but not intoxicating. This also extends downward along the edge of the outer wing to the very ground, thus alluring many creeping insects, and especially ants, to the more dangerous feeding-ground above, where, once losing foothold, it is impossible to regain it. Even flies escape but rarely, the form of the tube and lid seeming to effectually obstruct their flight. As the result, the tube becomes filled to the depth of some inches with a mass of decaying ants, flies, hornets, and other insects. Within this there is always found a white grub feeding upon the material thus gathered, perhaps the larva of a large fly which has been observed to stand upon the edge of the tube and drop an egg within it. Soon after the full development of the leaf the upper portion becomes brown and shrivelled, which is due to still another larva, the young of a small moth, which feeds upon the substance of the leaf, leaving only the outer epidermis, and works its way from above downward till in due time it spins its cocoon, suspending it by silken threads just above the surface of the insect *débris* at the bottom. The whole forms a series of relationships and an instance of contrivance and design, the full purport of which is still by no means fully understood. Other species of the genus, as also the allied Darlingtonia of California, manifest the same purpose of insect-capture, whatever the final object may be.

As complementary to Dr. Mellichamp's paper, Prof. C. V. Riley gave an account of his investigations on the insects more particularly associated with *Sarracenia variolaris*, which we shall reprint separately in an early number.

Number and Distribution of Fixed Stars is the title of a paper read by Prof. B. A. Gould, of Cambridge, Mass. The great work of Argelander undertook no less than a complete census of all stars in the northern hemisphere to the ninth magnitude inclusive, with as many as possible of the magnitude 9½. This was successfully executed, and an association comprising the great majority of northern observatories is now employing the working list thus obtained for the construction of a catalogue to fix star-places with the utmost attainable accuracy. The magnitudes are given to the tenth of a unit, from a number of observations on each, in the published catalogue, after having been first estimated by half units.

Prof. Littrow of Vienna made a careful enumeration of stars for each magnitude, to ascertain whether an approximate uniformity in the distribution of stars was indicated. If the magnitudes depend upon distances from us, and the stars are distributed with uniformity in space, the number of stars of any given magnitude should be proportioned to the spherical area within which they are observed. The truth of the hypothesis may be inferred from the degree of accordance between the numbers of stars of given magnitudes in the catalogue, and numbers computed from the contents of imaginary spherical shells whose radii would correspond with the respective magnitudes. An approximate indication might be obtained of the relative distances of each magnitude. Notwithstanding the difficulties which are incident to this method, due to inevitable errors of observation and comparison, Littrow believed that a sufficient degree of uniformity was demonstrated to justify faith in the general theory that there is a considerable degree of uniformity in the distances of the fixed stars within his investigation, and that there is warrant for applying his formulas—the results of his research—to regions outside of his limits. Discussing the numbers in Argelander's catalogue assorted by units as far as the eighth magnitude, he obtains the fraction 0·423 for the ratio of brilliancy between stars of two successive magnitudes; assorted by half units, the fraction is (including 8½) 0·431. Each computation gives the distance of a star of the eighth magnitude as 18, that of a star of average first magnitude being taken as a unit. The discordances between the results given by the empirical values of the formula and those from the enumeration of the catalogue are large, amounting to 39 per cent. for stars of the fourth, and 44 per cent. for stars of the ninth magnitude.

The recent completion of our Argentine Uranometry determines the actual magnitudes for all stars easily visible to the naked eye throughout the heavens. Prof. Gould thinks it improbable that the error of individual magnitudes exceeds the tenth of a unit. Prof. Heis has revised and extended Argelander's work to the nearest third of a unit for all stars visible in Central Europe with the naked eye, his lowest limit being 6½. The Argentine work furnishes similar data with respect to the stars in the southern hemisphere. Prof. Gould has carefully studied the results of Littrow's enumeration, is convinced of the accuracy of his computations, and accepts his formula as the best obtainable. Prof. Gould has extended a similar comparison to all the stars in the heavens of the sixth magnitude, using the numbers and magnitudes furnished by the uranometries, and obtains the value of the constant as 0·482. The accordance of this with observations may be judged from the following table:—

NUMBER OF FIXED STARS.

Magnitude.	Argelander.		Uranometries.		Whole Sky.	
	Count.	Formula.	North'n.	South'n.	Observ.	Formula.
1	6	4	8	6	14	23
1½	4	4	7	4	11	16
2	22	8	25	20	45	29
2½	12	15	35	33	68	50
3	51	28	55	41	96	85
3½	60	53	103	87	190	149
4	128	99	132	108	240	257
4½	140	186	254	154	408	444
5	379	350	392	240	632	768
5½	463	658	696	563	1,259	1,329
6	1,242	1,236	1,374	1,075	2,449	2,300
6½	2,231	2,322	—	2,022	—	3,976
7	4,608	4,362	—	3,317	—	6,879
7½	6,878	8,197	—	—	—	11,900
8	14,525	15,402	—	—	—	20,582
8½	28,486	28,937	—	—	—	35,601
9	78,185	54,370	—	—	—	61,582

The columns under "Argelander" give the numbers obtained respectively by enumeration and by the formula thence deduced, from the *Durchmusterung*, and, of course, apply only to the northern hemisphere. The columns under "Uranometries" are deduced from Heis's *Atlas Cœlestis* for the northern sky and from the Argentine Uranometry for the southern. Under the "Whole Sky" the first contains the sum of northern and southern stars from the columns immediately preceding; the second the numbers computed on the hypothesis of uniform distribution in space and equal brilliancy. Comparing these numbers with those obtained from the *Durchmusterung*, the latter must of course be doubled.

The carefully determined numbers of bright stars from the Uranometry afford no greater support to the hypothesis than those obtained from the *Durchmusterung*. While a general similarity between the numbers of count and of theory is apparent, the accordance is sufficient to warrant deductions which are not essentially vague. Still the approximate accordance, as far as it goes, may furnish us with a constant magnitude ratio for crude estimates in cosmical inquiries.

If we assume, according to hypothesis, an equal number of stars in each hemisphere, there are altogether not less than 15,300 stars as bright as the seventh magnitude. But since the count indicates an excess of bright stars in the northern sky, there may be a thousand more, as given by the formula. The numbers of the *Durchmusterung* imply the existence of over 200,000 stars as bright as the ninth magnitude, though the magnitudes of faint stars in that work seem given on the average a little too bright. The average distance of ninth magnitude stars seems to exceed 25. The manifest agglomeration of faint stars in the Milky Way shows the inapplicability of the hypothesis to stars fainter than a certain magnitude. The limit of applicability is probably considerably beyond stars of the seventh magnitude or distances twelve times the average of first magnitude stars. There is no contradiction in all this to the well-known fact of accumulation of brighter stars in certain regions.

With regard to the belief that the number of stars of any given magnitude diminishes with their distance from the Milky Way, Prof. Gould says that in the clear atmosphere of Cordoba the existence of a bright stream of stars was very noticeable, including Canopus, Sirius, and Aldebaran, with the most brilliant ones in Carina, Columba, Canis Major, the Pleiades, &c., and skirting the Milky Way on its preceding side. On the opposite side of the galaxy the same was true, the bright stars fringing it in a stream that leaves it at Alpha and Beta Centauri, comprises the constellation Lupus and a great part of Scorpio, and extends onward through Ophiucus toward Lyra. Thus a great circle or zone of bright stars seems to gird the sky, intersecting with the Milky Way at the Southern Cross, but far more conspicuous on the other. The northern intersection of this zone Prof. Gould finds in Cassiopeia, which is diametrically opposite to the Southern Cross. The right ascension of the northern node is 0 h. 50 m.; the southern 12 h. 50 m.; the declination about 60°, and very near the points where the great circle of the Milky Way has its maximum declination. The inclination of this stream of stars to the Milky Way is about 25°; the Pleiades occupying a point just midway between the nodes. Prof. Gould after making this discovery found that it had been partially anticipated by Sir John Herschel, so far as the recognition of a portion of the zone was concerned. The two classes of considerations—the approximate method furnished by the hypothesis of an equable distribution of stars, and the existence of a well-marked zone of very bright stars as much inclined to the Milky Way as the equator is to the ecliptic, may assist in determining the position of our sun with reference to its own cluster, that of the cluster itself, and the scale of distances between its constituent stars.

Prof. Wright read two papers on cognate subjects, one *On the use of Natural Twin Crystals of Quartz in the construction of Polariscopes*, and *On the nature of the Zodiacal Light and the distribution of matter which occasions it.*—Prof. Wright gave reasons for doubting whether the hypothesis of bodies rotating around the sun in all directions, and within the orbit of the earth, will account for the zodiacal light. The observed form of the zodiacal light is consistent with the supposition that the reflecting bodies move in long orbits—*i.e.*, orbits of great eccentricity.

Small Brains in Tertiary Mammals.—Prof. Marsh compares the mammals of the Eocene, Miocene, and Pliocene, with the result that in the case of the animals observed, Dinoceras and Brontotherium, a very distinct and remarkable development of brain from the lower to the higher formations.

Summer Dormancy of Butterfly Larvæ, by Prof. C. V. Riley, of St. Louis.—In this paper the author, referring to Mr. S. H. Scudder's paper in the *American Naturalist* for Sept. 1873, gave the results of his observations on the larvæ of *Phyciodes nycteis*, some of which appear to remain in a dormant state through the summer and succeeding winter.

The Disintegration of Rocks, by Prof. T. Sterry Hunt, of Boston.—This subject the speaker had noticed briefly in a communication to the Association last year on the geology of the Blue Ridge. The change of the rocks in question is a chemical one, which is the most obvious in the case of crystalline rocks; the feldspar loses its alkalies and part of its silver, being changed into clay, and the hornblende its lime and magnesia, retaining its iron and peroxide. From this results a softening and decay, to greater or less depths, of the strata, so that while they still retain their arrangement, and are seen to be traversed by veins of quartz and metallic ores, the strata are often so much changed to depths of one hundred feet or more from the surface as to be readily removed by the action of the water.

Fog Signals and Transmission of Sound, by Prof. Joseph Henry, of Washington.—Prof. Henry does not exactly accept the deductions recently made by Prof. Tyndall, having himself observed a large number of similar phenomena, and attributing them to refraction, not absorption, of sound by wind and other causes. Prof. Henry found Tyndall's explanation, that a mixed atmosphere absorbed sound, inadequate to explain the facts. The practical interference, and therefore the practical absorption, must be very inconsiderable compared with the volume of sound. In the case of the syren, such is the intensity of the sound that it would cause sand to dance on a stretched membrane at a distance of one-and-a-half miles, while a 2500-pound bell would not set the same sand in motion at a distance of thirty yards.

It has been frequently observed that a distinct echo is sometimes obtained from the ocean. Prof. Tyndall thinks the reflection is from surfaces of wind. Prof. Henry thinks it is from the surface of the waves of the ocean, and that the sound is afterwards refracted by the wind.

In a paper *On the Tails of Comets*, Mr. Henry M. Parkhurst endeavours to give data for predicting the form and appearance of these appendages.

Thermo-electric Properties of Minerals, by Professors A. Schrauf and E. S. Dana.—The interesting investigations of the late Gustave Rose, an eminent mineralogist at Berlin, have, during two or three years past, excited considerable interest in this subject. He began with the fact first announced by Hankel that some crystals of pyrite and cobaltite are electrically positive and others negative, and the endeavour to explain this opposite character on the assumption that it was connected with a condition of the right and left hemihedrism characteristic of both species. This touches a fundamental point in molecular physics, and if it could be sustained, Rose's hypothesis would be very valuable.

Schrauf and Dana, however, after the examination of a large number of minerals, comprising nearly all the metallic sulphids, have come to the conclusion that the cause of the variation of electrical character in this species must be sought elsewhere. They attribute it not to an opposite molecular condition shown in the hemihedral crystals, but to a change in chemical composition. They call their attention, in the first place, to the series of Seebach, where, for example, platinum occupies a varying position according to its degree of purity; moreover, they urge that the single case observed by Stefan, where some specimens of granular galena are positive and others of crystallised galena negative, is strong evidence against the influence of hemihedrism, as nothing of the kind can be assumed here. The force of their argument lies in the fact that they have found several other well-defined cases of minerals having peculiar varieties, and that among minerals crystallising holohedrally. Chemical analyses were here desirable to show how far the material under investigation varied in composition. In the absence of these, however, the specific gravity was resorted to as an indicator of the chemical character.

This afforded decisive results of plus and minus varieties of species, showing a decided difference in density and implying a corresponding change in composition. This was true also, in a marked manner, of cobaltite, and in a somewat less degree of pyrite, showing in each case where the explanation for the electrical character was to be looked for.

Several other conclusions were deduced from the long list of observations contained in the paper, but the foregoing will be sufficient to indicate its principal points.

Distribution of American Woodlands, by Prof. Wm. H. Brewer, of New Haven.—The flora of the United States, the author said, is believed to contain over 800 woody species, and over 300 trees. Of these trees, about 250 species are somewhere tolerably abundant, about 120 species grow to a tolerably large size, 20 attain the height of 100 ft., 12 a height sometimes of over 200 ft., and a few—perhaps 5 or 6—a height of 300 ft.

Notes on Tree Growth, by Prof. Asa Gray, of Cambridge, Mass.—Whether the trunk of a tree increases in length, in the parts once formed, is still an open question in the popular mind. From careful observations made by Prof. Gray and many others, the conclusion is that the trunks of trees do not grow in length.

Natural History at Penikese, by Prof. F. W. Putnam.—In speaking of the method of teaching at Penikese School, Prof. Putnam said :—"Text-books are not allowed. Our way was to give e ch student a specimen of fish and ask him or her to study that fish and tell the instructor what had been observed. Thus we developed their powers of observation upon the external character of the fish. After they had studied the fishes for about two days, they were called upon to state what they had seen. Then the anatomy of the specimens was gone into, and the students were led on step by step until they had secured a very firmly founded idea of the structure of a vertebrate animal. Then we asked questions as to the character of vertebrates, and finally they began to be original investigators. We really demonstrated in a practical way the subject, which is exciting so much attention now, of co-education of the sexes. We found that the ladies of the school were as capable in every way of making careful dissections and rendering careful accounts of the work they had done as the gentlemen, and, in fact, four or five of the ladies became original investigators before any of the gentlemen. This showed conclusively that the ladies had the power of becoming original investigators in science if they only would give the application."

Organic Change produced in the Bee, by Sophie B. Herrick, of Baltimore.—This was a very interesting paper, containing the authoress's own observations and experiments on bees.

The Reversion of Thoroughbred Animals, by Prof. Wm. H. Brewer.—It is often claimed that if the care of man be withdrawn an improved breed will retrace the steps of its ancestry and revert to its original characteristics. For some years Prof. Brewer has been investigating this subject and seeking for proof of the alleged tendency to reversion. To carefully-worded inquiries in writing, following upon every report of such "reversion," Prof. Brewer has received very numerous replies, and they are unanimously in the negative. This is certainly remarkable, following upon the confident assertions that animals so frequently exhibited the alleged tendency. The inquiries were pushed in the specific localities where the reversion was said to have occurred; the questions have been put to a large number of stock-breeders, and finally have been made by means of a printed circular. But the result was always the same, except that a smile of incredulity extended over the faces of some stock-breeders when such inquiries were put to them, and they feared they were to be made the victims of a "sell." No instances of the alleged "reversion" having been authenticated in Prof. Brewer's experience, he asked the Association to aid in exposing and refuting the pernicious notion.

REPORT OF PROF. PARKER'S HUNTERIAN LECTURES "ON THE STRUCTURE AND DEVELOPMENT OF THE VERTEBRATE SKULL" *

VII.—*Skull of the Snake* (Coluber natrix).

AMONG the most noticeable features of the Ophidian skull may be mentioned the ivory-like texture of the bones, the immense strength and compactness of the brain-case, and the equally remarkable mobility of the facial bones, the maxillary and palatine apparatuses and the lower jaw being arranged in such a way as to allow of the greatest possible extension of the mouth during deglutition. Another important characteristic is the bony completeness of the brain-case, which is as thoroughly closed in as that of a mammal, scarcely any part of its walls being formed in the adult either by cartilage or fibrous tissue; the inter-orbital septum, also, or laterally compressed anterior moiety of the basis cranii, so characteristic of the Sauropsida, is absent, the base of the skull being flat throughout, and abruptly terminated in front. But the most interesting and at the same time most anomalous feature is the persistence of the fœtal trabeculæ, in the form of two slender cartilaginous rods (Fig. 23, Tr), lying in grooves on either side of the parasphenoid.

The hinder part of the skull is formed by a well-ossified occipital segment, the four elements of which are firmly united with one another by suture; the single convex occipital condyle is borne chiefly by the basi-occipital, the exoccipital, however, taking a considerable share in its formation. The basi-occipital is continued forward by a broad, expanded, basi-sphenoid, produced anteriorly into a slender prolongation or rostrum (Fig. 22, Pa.S), which underlies the front half of the brain-case, and answers to the parasphenoid bone.

The parietals are completely fused together in the mid-line, where they are produced in the Pythons and Boas into a strong sagittal crest for the attachment of the temporal muscles. In their hinder half they are simply roofing bones, as in Lizards and Amphibia; but in front of the auditory capsule they extend downwards (Fig. 23, Pa¹) and meet the parasphenoid, forming with it a complete cylindrical cavity. The frontals, unlike the parietals, have only a sutural union with one another; but they, too, are produced downwards (Fr′), and, moreover, come into contact with one another below, above the parasphenoid, so as to form

* Continued from p 250.

unaided the whole of the anterior third of the brain-case—roof, walls, and floor. There is yet another important feature in these curious bones—the cylindrical cavity which they enclose is divided in front by a double pillar of bone, to which each frontal contributes its own half, and on either side of which the olfactory nerves pass to the nasal sacs: in this way a remarkable resemblance, both in form and position, to the frog's "girdle-bone" is produced; an analogy, indeed, which only the study of

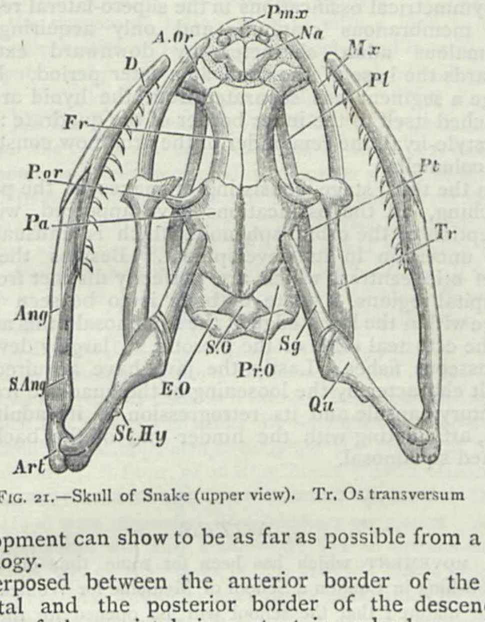


FIG. 21.—Skull of Snake (upper view). Tr. Os transversum

development can show to be as far as possible from a true homology.

Interposed between the anterior border of the ex-occipital and the posterior border of the descending portion of the parietal, is a stout irregular bone, which anyone studying the adult skull only would certainly look upon as the periotic or ossified otic capsule. As a

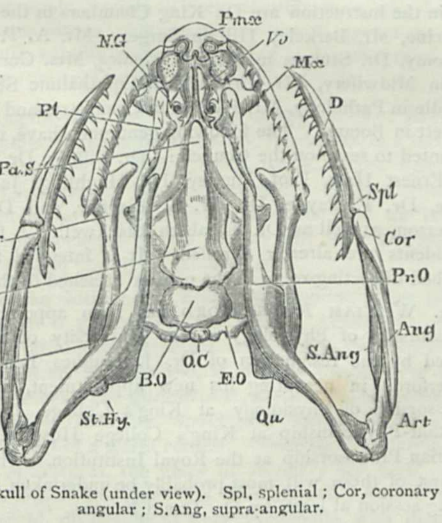


FIG. 22.—Skull of Snake (under view). Spl, splenial; Cor, coronary; Ang, angular; S.Ang, supra-angular.

matter of fact, however, it is both more and less than this. In the young state it consists of two perfectly distinct ossifications, between which the fifth nerve makes its exit. Now, this nerve (see NATURE, vol. x., p. 10) marks the line of demarcation between the posterior boundary of the parietal segment and the auditory capsule; the bone in front of it is, therefore, the alisphenoid, and that behind it the prootic, the latter being further determined by the fact that it lodges the main part of the vestibule, of the anterior and horizontal canals, and of the rudimentary cochlea. The remaining elements of the ear-capsule are, in the adult, quite undistinguishable; it is seen, however, that the arch of the posterior canal, as far forward as its junction with the anterior, extends into what appears to be the supra-occipital, and that the ampulla of the posterior and the hinder portion of the horizontal canals invade, in like manner, the ex-occipital. The explanation of this seeming anomaly—so common in the Sauropsida—is to be found in the snake at the time of hatching, when the pro-, epi-, and opisthotic elements are perfectly distinct from the neighbouring bones as well as from one another: as

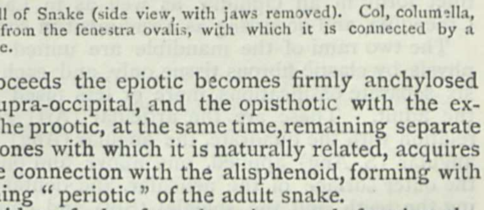


FIG. 23.—Skull of Snake (side view, with jaws removed). Col, columella, displaced from the fenestra ovalis, with which it is connected by a dotted line.

growth proceeds the epiotic becomes firmly anchylosed with the supra-occipital, and the opisthotic with the ex-occipital: the prootic, at the same time, remaining separate from the bones with which it is naturally related, acquires an intimate connection with the alisphenoid, forming with it the seeming "periotic" of the adult snake.

At the sides of the frontal region, and forming the anterior and posterior boundaries of the orbit, are two representatives of the "lateral line series" so prominent in osseous fish: these are the antorbital and the post-orbital. The antorbitals are large triangular bones, and between them lie the nasals, which together have a rhomboid form, and the inner edges of which are turned downwards, forming vertical plates similar to the inter-olfactory pillars of the frontals. In front of the nasals, and forming the termination of the snout, is the small toothless premaxilla, an azygos bone, with short nasal, maxillary, and palatine processes. The vomers are two hollow,

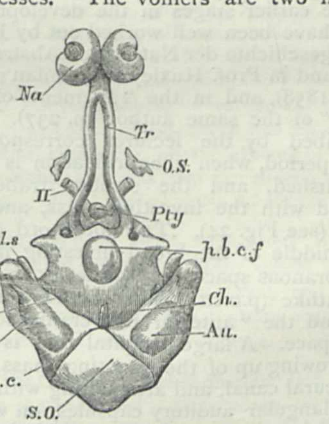


FIG. 24.—Chondro-cranium of Embryo Snake (upper view). p.b.c.f, posterior basi-cranial fontanelle.

scroll-shaped bones, bearing on their excavated upper surfaces the nasal glands; the ducts of these pass through a notch in the outer border of the vomers, which is converted into a foramen by means of a triangular ossification, the septo-maxillary, here attaining its greatest development. The duct of the nasal gland is also supported on the outer side by two labial cartilages (l).

The foregoing bones are all compactly united with one another; the remaining ones, forming the powerful manducatory apparatus of the upper and lower jaws, are articulated only by loose fibrous tissues, and are thus rendered capable of the greatest possible amount of extension.

On the upper surface of the skull, clamping the lateral occipital region and projecting backwards for fully half its length beyond the latter, is the flat sabre-like squamosal (Fig. 21, Sq), articulated to the hinder end of which, and thus carried completely away from the auditory region, is the quadrate, a stout bone passing obliquely downwards and outwards, and giving attachment by a rounded pulley-like surface to the mandible. On the inner edge of the quadrate, and partly coalesced with it, is a small nodular ossification representing the stylo-hyal (Figs. 21 and 22, St.Hy). The palatines and pterygoids are well developed and bear large recurved teeth; the latter extend backwards to the quadrate, to which they are united by ligaments just above its articular surface. The maxillæ are large strong bones lying parallel with the palatines and the front half of the pterygoids, and forming an outer dentigerous arch. Between the hinder end of the maxilla and the centre of the pterygoid runs a stout bone, the os transversum, found in this distinct form in all Ophidia, as well as in Lacertilia and Crocodilia, and occurring as a rudiment in some birds.

The two rami of the mandible are united at the symphysis by elastic fibrous tissue only, and each consists of six separate ossifications more or less fused together in the adult. These are the articular (Art) coming into relation with the quadrate, the angular (Ang) and supra-angular (S. Ang) applied, one above and one below, to the outer surface of the articular, the dentary (D) bearing the teeth, and the splenial (Spl) and coronary (Cor) appearing only on the inner surface.

The columella or auditory ossicle is extremely small in the common snake (Fig. 23, Col), and consists of a plug of bone fitting into the fenestra ovalis by a rounded disc-like end, the stapes, and of an extremely short rod anchylosed with and projecting backwards from the disc, which is all that represents the stapedial bones of the frog. In many of the larger serpents, both venomous and harmless, the columella is a rod of very considerable length, tipped at its end, in some cases, by an expanded cartilaginous flap, the homologue of the extra-stapedial.

The earlier stages in the development of the snake's skull have been well worked out by Rathke (" Entwickelungsgeschichte der Natter "). Abstracts of his views will be found in Prof. Huxley's Croonian Lecture (Proc. Roy. Soc., 1858), and in the " Elements of Comparative Anatomy " of the same author (p. 237). The earliest stage described by the lecturer corresponds with Rathke's third period, when chondrification is already thoroughly established, and the slender trabeculæ have united behind with the investing mass, and in front with each other (see Fig. 24). The notochord (Ch) reaches only to the middle of the broad investing mass (I.M), a large membranous space, the "posterior basi-cranial fontanelle" of Rathke (p.b.c.f) being between its anterior pointed end and the " anterior basi-cranial fontanelle," or pituitary space. A large occipital ring is already formed by the growing up of the investing mass around and above the neural canal, and articulating with its edges are the sub-triangular auditory capsules, on which the elevations caused by the semicircular canals (a.s.c, p.s.c, h.s.c) are particularly well marked. The trabeculæ diverge strongly in the pituitary region, in front of it run almost parallel, having between them the tissue from which the para-sphenoid is afterwards formed, and eventually unite and expand into the large reniform roofs of the nasal sacs (Na). The alisphenoids (Al.s) are already chondrified, but the orbito-sphenoids (O.s) are backward in development, being mere patches of indifferent tissue in front of the exit of the optic nerve (II). The mandibular arch is completely divided into a short quadrate and a long Meckel's cartilage. The hyoid arch is cartilaginous only in its upper part, and its apex is already fused with the stapes.

In the second stage all the bones of the adult have appeared with the exception of the alisphenoid, orbito-sphenoid, columella, stylo-hyal, and otic bones. The basi-occipital arises in the same manner as the urostyle of a frog or osseous fish,* as a bony deposit in the sheath of the notochord, affecting subsequently the surrounding cartilage; the basi-sphenoid makes its appearance as a pair of ossific centres, one on each side of the apices of the trabeculæ, where they join the investing mass. The parietals and frontals are quite normal in their development, arising as symmetrical ossifications in the supero-lateral region of the membranous cranium, and only acquiring their anomalous adult character by downward extension towards the base of the skull at a later period. In this stage a segment has separated from the hyoid arch and attached itself to the inner border of the quadrate: this is the stylo-hyal, the remainder of the arch now constituting the columella.

In the third stage, consisting of snakes at the point of hatching, all the ossifications have appeared, with the exception of the orbito-sphenoid, which is unusually late and uncertain in its development. Besides the three chief otic centres, which are perfectly distinct from the occipital regions, a plate of bone is to be seen in this stage within the lower edge of the squamosal: this answers to the ectosteal plate of the pterotic, so largely developed in osseous fishes. Lastly, the jaws have acquired their adult character by the loosening of the quadrate from the auditory capsule and its retrogression to its adult position, articulating with the hinder end of the backward-turned squamosal.

NOTES

A MOVEMENT which has been for some time on foot for establishing in London a School of Medicine for Women is now so far matured that the school will be opened for the winter term on Oct. 12, in commodious premises, 30, Henrietta Street, Brunswick Square. The full staff of lecturers has not yet been appointed, but among those who have already consented to take part in the instruction are Dr. King Chambers in the practice of Medicine, Mr. Berkeley Hill in Surgery, Mr. A. T. Norton in Anatomy, Dr. Sturges in Materia Medica, Mrs. Garrett Anderson in Midwifery, Mr. Critchett in Ophthalmic Surgery, Dr. Cheadle in Pathology, Mr. Heaton in Chemistry, and Mr. A. W. Bennett in Botany. The following gentlemen have, in addition, consented to serve on the Council:—Dr. Billing, Dr. Buchanan, Mr. Ernest Hart, Prof. Huxley, Dr. Hughlings Jackson, Dr. Murie, Dr. F. Payne, Dr. W. S. Playfair, and Dr. Burdon-Sanderson, as well as Dr. Elizabeth Blackwell. A fair number of students are already enrolled. It is intended to build a detached dissecting-room in the garden attached to the house.

DR. WILLIAM RUTHERFORD has been appointed to the Professorship of Physiology at the University of Edinburgh, vacated by the resignation of Dr. J. Hughes Bennett. Dr. Rutherford, in accepting his new appointment, vacates the Professorship of Physiology at King's College, London, the Assistant-Physicianship at King's College Hospital, and the Fullerian Professorship at the Royal Institution. The duties of the first of these will most probably be undertaken, during the coming session at least, by Dr. David Ferrier.

DR. ADOLF BERNHARD MEYER, the recent explorer of New Guinea, has been appointed director of the Zoological Museum at Dresden, in succession to Dr. Reichenbach, who has retired.

* In these types a variable number of vertebræ at the termination of the column undergo a process of absorption, and a single ossification appearing in the sheath of the notochord constitutes the urostyle or coccyx. In the head a similar process takes place at the anterior end of the notochord, where a number of vertebræ may be considered to have been suppressed, forming what may be termed a " cephalostyle ": the bony deposit spreading from this into the investing mass, gives rise to the basi-occipital.

Dr. Meyer entered upon his new duties on the first of last month.

A CORRESPONDENT with the Transit of Venus Expedition to Honolulu, writing from Valparaiso, informs us of the safe arrival there of the party after a particularly fine passage south; the weather was not so favourable up the Chili coast.

A LARGE and influential meeting of the professional and private friends of the late Dr. Anstie was held on the 23rd ultimo, at the house of Dr. George Johnson, in Savile Row, for the purpose of taking steps to raise a fund to be applied in perpetuation of Dr. Anstie's memory, and in recognition of his public and professional services. Dr. Burdon-Sanderson moved, and Dr. Glover seconded, a resolution—"That, considering the labours of the late Dr. Anstie for the promotion of science, and the circumstances of his untimely death, it is desirable that some permanent memorial of his career should be established." In speaking to this resolution, it was pointed out that Dr. Anstie's widow and three young children were but slenderly provided for, and hence that his only son would probably be unable to obtain the complete education which his father, if his life had been spared, had intended to secure for him. It was felt that the proposed memorial might fittingly take the form of a fund to be devoted to this object, and it was hoped that such an application of money might not be unacceptable to his family, and might be received by them as a fitting tribute to the estimation in which Dr. Anstie was held. By subsequent resolutions, a large committee was appointed to carry out the objects of the meeting, and Mr. J. S. Storr, of 26 King Street, Covent Garden, was appointed treasurer, and Mr. Brudenell Carter and Dr. Wharton Hood were appointed joint honorary secretaries. An executive committee was also nominated; and an opinion was expressed that the circumstances of Dr. Anstie's death, in the discharge of his duty, as well as much of the work which he had done during life to ameliorate the condition of the poor, were sufficient to justify an appeal to the general public as well as to his own profession.

THE Photographic Society invites scientific men who have turned their attention to photography to furnish specimens for their forthcoming exhibition. It is proposed to devote a room to the purely scientific applications of the subject.

WE would again draw the attention of secretaries of British scientific societies to the proposed work referred to in a recent number (NATURE, vol. x. p. 407) by M. Rauïs, of the Belgian Academy—a Dictionary of Learned Societies. He is of course anxious to get full and trustworthy information, and we hope that the numerous societies of this country will lend him every assistance in carrying out his valuable scheme.

THE news of the death of M. Elie de Beaumont, in his 76th year, has thrown a gloom over the French Academy. We believe that his position of perpetual secretary to the Academy will be conferred on M. Bertrand, at present president of the Academy of Sciences. The *fauteuil* of M. Bertrand, who is a member in the section of Geometry, would thus become vacant, and would be the object of a warm contest. Since the foundation of the Academy of Sciences, the place of secretary has been permanent, while that of president has been annual. Among the predecessors of M. de Beaumont were Fontenelle, who died a centenarian after having occupied his *fauteuil* for sixty years, Condorcet, Fourrier, Delambre, and Arago, whom De Beaumont succeeded, the two together having held office for more than half a century. Since the death of Flourens, M. Dumas has been secretary for the Physical Sciences.

AT the Aberdeen Cryptogamic show referred to in last week's NATURE, p. 427, a meeting of botanists was held, when it was agreed to form a Scottish Cryptogamic Society, which, by an annual exhibition held in the larger cities by rotation, and by other means, would endeavour to promote a more general and deeper knowledge of cryptogamic plants. It is intended to hold the exhibition for next year at Perth.

THE first session of the Yorkshire College of Science, Leeds, opens on the 26th inst. There are already four professorships—Mathematics and Experimental Physics (Prof. Rücker), Chemistry (Prof. Thorpe), Geology and Mining (Prof. Green), Textile Fabrics (Prof. Walker).

THE expedition organised in June last by Captain Williams, of Sunderland, in the steamship *Diana*, belonging to Mr. Lamont, of Dundee, has returned to the latter port. The Novaya Zemlya region was the scene of the *Diana's* cruising; the Gulf of Obi was reached, and the conclusion come to that without difficulty a vessel might make Behring Strait. Capt. Wiggins, who was in command, endeavoured to assist the Austrian expedition, but was compelled to give up the attempt. Curiously, however, the *Dinaa* reached Hammerfest just an hour before the members of the Austrian expedition. Some important corrections of the geography of the region around the mouth of the Obi have been made.

THE council of the Institution of Civil Engineers have issued a list of subjects for premiums to be awarded during session 1874-75. Information with regard to the premiums, which are valuable, is prefixed to the list, and we advise those interested to apply to the secretary for information.

THE Council of the Institution of Naval Architects have had under consideration the question of providing a good series of contributions for their next session. They have accordingly prepared a list of subjects, which they desire to submit to the members and associates of the Institution, and others interested in shipbuilding, as questions on which they will be glad to receive communications for the annual general meeting in March (17th to 20th), 1875. Anyone wishing a list of the subjects should apply to the Secretary, 20, John Street, Adelphi.

THERE are several reports to hand of recent earthquakes. There was a violent shock at Randazza, Sicily, on Sept. 27, and several houses were injured. Rumbling noises are audible from Mount Etna.—Intelligence published at New York on Sept. 26 reports that the town of Antigua, in Guatemala, has been destroyed by an earthquake.—Several shocks of earthquake were felt at Delhi on Aug. 31, at 5.25 A.M.—A shock was felt near Sucklaspore, in the Madras Presidency, on the evening of the 17th Aug. The direction of the shock was from east to west, and the duration seven seconds.

A TERRIBLY destructive typhoon swept over Hong Kong about 12 o'clock on the night of Sept. 23. Many vessels were wrecked and the loss of life is estimated at 1,000, and the damage done to property is immense. The typhoon reached Macao, causing there also a fearful amount of damage.

ONE of the Limuli at the Crystal Palace Aquarium died last week from the effects of the continued attacks made on it by lobsters in the same tank. The other Limuli are now in a separate tank.

THE Swiss Society of Public Usefulness, says the *Continental Herald*, which met at Friburg from the 21st to the 23rd inst. inclusive, treated the subjects engaging its attention under two heads, viz., Public Instruction and Industry. Under the first head it discussed whether the professional teaching now given in the Confederacy should be altered; whether in the secondary schools for boys a larger share of scientific education ought not to be given, combined with practical exemplification, manual labour, and experience in industrial chemistry; whether in the secondary and superior schools for girls sufficient attention is paid to the class of studies which will be of service in careers now open to women, and if their education is directed towards facilitating their entry into new occupations; whether it would not be advisable to introduce into secondary schools for girls commercial education and the study of drawing as applied to manufactures, such as those of ribbons, lace, printed stuffs, wall papers, &c.

A NEW horticultural garden has been opened at St. Petersburg under Imperial patronage. It is fifteen acres in extent, and is to be devoted principally to illustrate how native plants may be combined for pretty and tasteful decorations. One large portion is to be devoted to conifers, in order that there may be, even in winter, green promenades.

THE consumption of osiers for various purposes, in England especially, is very great. Besides her own production, this country imports more than 5,000 tons, valued at about 40,000*l*. About 300 varieties of osiers are known, the most important beds being situated near Nottingham; the home produce being insufficient to meet the demands, great attention is being paid to the cultivation beds in Australia, and a considerable quantity is yearly produced in that country.

THE cultivation of the Angora Goat is attracting some attention in Australia, where this animal appears to thrive very well. The hair is said to make a very good "mohair" fabric, but its quality depends very much upon the nature of the locality in which the animals are reared. Undulating prairies with a good supply of pure water are best adapted to the habits of this goat. In sandy hilly districts it thrives admirably, but the hair is inferior and falls off very quickly. The flesh is excellent, and is preferred in some parts of Australia to the best mutton. The milk is of good quality and yields a good supply of butter and cheese. The hair is worth about four shillings a pound, and one ram will yield about four pounds at each shearing; the best plan is to shear them twice a year, as this prevents the hair from falling off and from splitting; at each shearing it is about six inches long. Compared with the merino sheep, the Angora goat seems to have the advantage in the fact that the former produces only three-and-a-half pounds of wool, worth two shillings and sixpence per pound, and that six merinos will eat as much as seven Angoras. These facts are important in view of the acclimatisation of the Angora goat in other parts of the world.

THE New Zealand Flax (*Phormium tenax*) is being cultivated in St. Helena, and there seems no reason why the same thing should not be done in other countries. Hitherto no very great attention has been paid to the cultivation of this plant, but the natural supplies obtained in New Zealand are insufficient for the demands of commerce. It is a mistake to suppose that an illimitable supply can always be obtained because no cultivation has been necessary in the first crops of the wild produce. This is not to be regretted, for careful cultivation cannot fail to greatly improve the fibre, and the best kinds alone will be worth the trouble of proper rearing. Steps are however being taken to cultivate the plant in New Zealand and in other countries which have been fortunate enough to acclimatise it. In the Azores, at St. Helena, in Algiers, and the south of France, it thrives well, and has been easily naturalised. The fibre is principally used for making ropes and paper, for the caulking of vessels, for stuffing mattresses, and for coarse textile fabrics. The seeds yield a valuable oil when crushed.

THE Crystal Palace Company are to give a magnificent fête on behalf of the Hospital Saturday Fund on the 5th inst.

M. HENRY COCKERILL, of Aix-la-Chapelle, nephew of the late John Cockerill, we learn from the *Journal of the Society of Arts*, who founded the great engineering establishment at Seraing, near Liege, which until the immense extension of the Creuzot works was the largest on the Continent, has placed at the disposition of the Société Cockerill the sum of 50,000 francs, to be invested in the public funds of Belgium, the interest to be applied to the endowment of scholarships, to enable the sons of workmen, or others employed by the society, to attend the courses of study at the Mining School of Liege.

THE popular demand in America for a complete series of the annual reports of the United States Geological Survey of the Territories, under the charge of Dr. F. V. Hayden, has been so great that the Secretary of the Interior has ordered the printing of a second edition of the first three annual reports in one volume. A compact 8vo. of 261 pp. with index has in consequence been issued. The survey in its present form commenced in the spring of 1867 with the small grant of $5,000 for the survey of Nebraska, and the following year a similar grant was made for Wyoming. During these two years the survey was under the General Land Office, and the first and second annual reports were included in the reports of the commissioner. Their reprint is a great convenience for reference. In the third year (1869) the survey was placed by Congress under the Secretary of the Interior, and $10,000 was granted for the examination of Colorado and New Mexico. The volume for that year was issued as an independent volume, and was reviewed in NATURE, vol. iv. p. 24. These reports differ from the memoirs of our English survey, which are in illustration of single sheets or sometimes quarter sheets of maps of the survey, for a United States Report includes a whole State. Our own enter into detail; these give general views. Further, these reports give not only the geological and palæontological features and mineral resources of a State, but its agricultural condition and prospects are included. Speaking of the treeless prairies, Dr. Hayden expresses his belief that forests may be restored in a short time, and gives many illustrations of what planters have effected in ten years in Nebraska. Cotton-wood (*Populus monilifera*), Soft Maple (*Acer rubrum*), Elm (*Ulmus americana*), Bass-wood or Linden (*Tilia americana*), Black Walnut (*Juglans nigra*), Honey Locust (*Gleditschia tricanthus*), and Willows, are the trees mostly cultivated. English agriculturists may perhaps be astonished at hearing crops being spoken of as promising because the grass-hoppers have left a full half crop of wheat. In the first report are some interesting notes on the present condition of the Otoe Indians; and notes by Dr. Newberry and Prof. Heer, on the fossil leaves of the Dokata group; while the second report includes a sketch of the physical geography of the Missouri Valley. Although called a geological survey, climatal and meteorological observations are interspersed, as well as much information about game and wild animals. There is also much valuable agricultural information, that alone would create a large demand for the reprint.

WE have received the Eighth Annual Report of the Aëronautical Society. The report is mainly occupied with an account of experiments and calculations which have been recently made, and contains a paper by Mr. D. S. Brown on the Aëroplane, and a long and elaborate paper by Mr. James Armour, C.E., entitled "Wings for Man."

THE additions to the Zoological Society's Gardens during the past week include a Praslin Parrakeet (*Coracopsis barklyi*) and four Red-crowned Pigeons (*Erythrænas pulcherrima*) from the Seychelles, presented by the Hon. Sir Arthur Gordon; two Burchell's Bustards (*Eupodotis kori*) from S. Africa; a Hocheur Monkey (*Cercopithecus nictitans*) from W. Africa; a Punjaub Wild Sheep (*Ovis cycloceros*) from N. W. India; two Blackish Sternotheres (*Sternothærus subniger*) from the Seychelles; a Common Octopus (*Octopus vulgaris*) from the British Seas, deposited.

THE BRITISH ASSOCIATION

REPORTS

Tabular View of the Classification of the Labyrinthodonta, by L. C. Miall. Summary of the Second Report on Labyrinthodonta.

AMPHIBIA

LABYRINTHODONTA.

A.—*Centra of dorsal vertebræ discoidal.*[1]—Genera 1 to 25.

I.—EUGLYPTA. Cranial bones strongly sculptured. Lyra conspicuous. Mandible with well-developed post-articular process. Teeth conical; their internal structure complex; dentine much folded. Palato-vomerine tusks in series with small teeth. Short inner series of mandibular teeth. Sculptured thoracic plates, with reflected process upon the external border.

* *Palatine foramina large, approximated.*

† *Mandible with an internal articular buttress.*

‡ *Orbits central or posterior.*

1. Mastodonsaurus, Jäger.
2. Capitosaurus, Munst.
3. Pachygonia, Huxley (?).
4. Eurosaurus, D'Eichwald (?).
5. Trematosaurus, Braun.
6. Gonioglyptus, Huxley.

‡‡ *Orbits anterior.*

7. Metopias, Von Meyer.
8. Labyrinthodon, Owen.[2]

†† *Mandible without internal articular buttress.*

9. Diadetognathus, Miall.

** *Palatine foramina small, distant.*

10. Dasyceps, Huxley.
11. Anthracosaurus, Huxley.

II.—BRACHYOPIDA. Skull parabolic. Orbits oval, central or anterior. Post-articular process of mandible wanting (?).

12. Brachyops, Owen.
13. Micropholis, Huxley.
14. Rhinosaurus, Waldheim.
15. Bothriceps, Huxley.

III.—MALACOCYLA. Skull vaulted, triangular, with large postero-lateral expansions. Lyra consisting of two nearly straight longitudinal grooves, continued backwards as ridges. Orbits large, posterior, irregular. Temporal depressions, passing backwards from orbits. No post-articular process to mandible.[3]

* *Teeth with large anterior and posterior cutting edges.*

16. Loxomma, Huxley.

** *Teeth conical.*

17. Zygosaurus, D'Eichwald.

IV.—ATHROÖDONTA. Maxillary teeth wanting. Vomerine teeth aggregated. Orbit imperfect.

18. Batrachiderpeton, Hancock and Atthey.
19. Pteroplax, Hancock and Atthey.[4]

[V.—An uncharacterised group for the reception of some or all of the following genera.]

20. Pholidogaster, Huxley.
21. Ichthyerpeton, Huxley.
22. Pholiderpeton, Huxley.
23. Erpetocephalus, Huxley.

VI.—ARCHEGOSAURIA. *Von Meyer.* Vertebral column notochordal. Occipital condyles unossified.

24. Archegosaurus, Goldfuss.
25. Apateon,[5] Von Meyer.

B.—*Centra of dorsal vertebra elongate, contracted in the middle.*

VII.—HELEOTHREPTA. Skull triangular, with produced, tapering snout. Orbits central. Mandibular symphysis very long, about one-third of the length of the skull.

26. Lepterpeton, Huxley.

VIII.—NECTRIDEA. Epiotic cornua much produced. Superior and inferior processes of caudal vertebræ dilated at the extremities and pectinate.

27. Urocordylus, Huxley.
28. Keraterpeton, Huxley.

IX.—AISTOPODA. Limbs wanting.

29. Ophiderpeton, Huxley.
30. Dolichosoma, Huxley.

X.—MICROSAURIA, *Dawson.* Thoracic plates unknown. Ossification of limb-bones incomplete. Dentine non-plicate, pulp cavity large.

31. Dendrerpeton, Owen.
32. Hylonomus, Dawson.
33. Hylerpeton, Owen.

[1] This character is not of primary importance, but seems to be available for an arrangement determined by other considerations.
[2] Orbits unknown.
[3] Loxomma.
[4] The vomerine teeth are unknown, and this genus may therefore require to be removed.
[5] Of doubtful distinctness.

SECTIONAL PROCEEDINGS

SECTION A—MATHEMATICS

On the Photographic Operations connected with the coming Transit of Venus, by Captain Abney, R.E., F.R.A.S.

As is doubtless well known to all, there will be an application of photography to register the passage of Venus across the sun's disc, and it may not be amiss to give an outline of the processes, &c., that will be adopted. It has been determined by the Astronomer Royal that at every photographic station a photograph shall be taken every two minutes during the transit, and it has been a matter of considerable labour to work out a process that will admit of such a large number of negatives being taken in a hot climate. In Kerguelen's Land it would be perfectly feasible to adopt the ordinary wet process, the low temperature admitting of it, but in a temperature of 90° F. the evaporation of the volatile constituents of the collodion would render such a procedure inapplicable, as all practical photographers will admit. In India, where I have worked extensively, coating two or three plates in succession in a large-sized tent has sometimes proved injurious. With such experience I venture to think that it would have been madness to trust to the wet method for four hours, unless the conditions of *personnel* of the parties were considerably altered. Sir G. Airy, after much anxious deliberation, and with the advice (and that not hastily formed, by any means) of Mr. De la Rue, determined to adopt a dry process if practicable. After considerable experiments conducted at Chatham, it was determined to adopt an albumen dry process, using a highly bromised collodion, and strong alkaline development. There were several advantages in this:—(1) At the critical time the photographers would have nothing to distract their attention excepting placing the dry plates in the slide and developing every twelfth plate exposed, in order to regulate the exposure; (2) the irradiation was much diminished by the use of albumen, a point of no small importance when measurements have to be taken; (3) the shrinkage of the film is reduced to zero when the plates are properly prepared.

In regard to the first advantage claimed, it will be apparent that plates prepared at leisure will have a much superior advantage to those prepared in the hurry of the moment as would be the case with wet plates. The chances of stains and spots are diminished tenfold, and we may expect a much clearer picture.

The true explanation of irradiation has been argued of late in NATURE, and perhaps I may be pardoned for dwelling an instant on that point. Irradiation may be divided into two kinds, viz., that occurring from reflection from the back of the plate, and that occurring from reflection from the particles of bromide or iodide of silver in the collodion film. The first requires no explanation. If a film be insufficiently dense and of such a colour as will cut off the most active rays of the spectrum, no irradiation on that account need be anticipated. Iodide of silver fulfils this condition much more fully than does bromide of silver, the former approaching to a yellow colour, whilst the latter is almost white. A thin layer of iodide is much more efficient in cutting off the blue end of the spectrum than is the bromide; hence, if irradiation through reflection from the back of the plate is to be overcome, it is wise to use a certain proportion of iodide in the collodion. Practically I have found that in the dry process under consideration, three parts of iodide to two of bromide give the best results without diminishing the sensitiveness of the film. The second cause of irradiation, viz., reflection from the particles of bromide and iodide, is not hard to explain. When a colloid body such as gelatine or albumen is brought in contact with a soluble salt of silver, the resisting compound is found to be one which is singularly free from this defect. If a ray of light be allowed to fall at right angles upon a very thin cell containing an emulsion of bromide of silver, the cell having worked glass sides and ends, it will be found that the ray of light will be scattered considerably, apparently in a logarithmic curve; the surface nearest the source of light will not be affected, but it will spread from that surface towards the other, a physical line of light becoming an area. If, however, a colloidal salt of silver be introduced it will be found that this area is much diminished, and for small distances becomes inappreciable. In connection with this I may mention that bromide plates, even when backed with a non-actinic backing in optical contact with the plate, will give irradiation with alkaline development, whilst with acid development the irradiation will disappear. The explanation is not far to seek—the alkaline development reduces the silver *in situ*, the acid development deposits silver on the surface and where there is most attractive force. In the former case, the dispersed light acting on the interior of the film, causes the necessary change in the bromide of silver to effect reduction. Daguerreotype plates are not free from irradiation as has been supposed, though, owing to the extraordinary thinness of the iodide of silver, but little effect can be traced unless very prolonged exposure be given.

In the dry process selected for the transit of Venus it has then been thought desirable to have a rather dense film containing a proportion of iodide of silver and a colloid body—albumen—as preservative. I am not unmindful of the fact that different pyroxylines more or less affect irradiation, and we have altered the constitution of the pyroxyline in the collodion I shall use, by adding certain proportions of water; this materially aids the annihilation of irradiation from these plates.

For registering the time of external and internal contact of the planet with the sun's disc, the method known as Janssen's has been adopted, viz., causing a fresh portion of a plate to be exposed every second during the critical time, to the sun's limb, at that part where the contact will take place. Mr. Christie and Mr. De la Rue have both devised a slide for this purpose. The English parties use that designed by the former, whilst Colonel Tennant will use that by the latter. Shrinkage in the film has been carefully looked for by Dr. Vogel, of Berlin, and also by myself. Photographing a grating of 200 lines to the inch by contact printing, and measuring the results, I have been unable to find any alteration in the distances of the lines at any part of the film, hence I feel confident that any shrinking that can take place will be so small as to be negligible. The Russian parties are, I believe, going to use a grating material of iron wires. If shrinkage does occur this would be necessary, but it seems almost useless, in fact hurtful, where there will be none. There must be a certain error introduced due to the grating itself. The method of finding the angle of the position of the wires will be determined photographically. Two pictures of the sun will be taken at an interval of one minute on the same plate. The line forming the intersection of the sun's images will give the angle of position of the wires when measured by the micrometer. At each station the photographic party will consist of one officer and three sappers, all of whom have been trained in the use of the photo-heliograph and the process employed. A drill for each operation has been devised, and it is anticipated that the dangers of excitement during the critical times have been overcome by this arrangement. Practice on a mock transit has ensured a thorough knowledge of each phase of the phenomena; and I apprehend that discipline combined with a trust in their superiors will have annihilated one source of failure.

On the importance of improved methods of Registration of Wind on the Coast, with a notice of an Anemometer, designed by Mr. W. De la Rue, F.R.S., to furnish telegraphic information of the occurrence of strong winds, by Robert H. Scott, M.A., F.R.S.

It is hardly necessary to draw the attention of the Section to the fact that the configuration of the earth's surface exercises an overwhelming influence on the wind both as to its direction and force. Some statements and tables contained in a paper of mine in the last number of the *Quarterly Journal* of the Meteorological Society * abundantly prove this assertion, and it is therefore easy to see what an imperfect representation of the actual force of the wind at sea can be furnished by reports from a broken and mountainous coast, such as the Atlantic coasts of Ireland and Scotland, where the telegraphic stations are perforce situated in sheltered places, inasmuch as harbours are naturally found where there is as little exposure to wind as is possible.

In the practice of weather telegraphy and storm warnings, as the number of reports received per day from each station is strictly limited, on financial considerations, it is quite obvious that if the actual epoch of the commencement of a gale does not fall within the hours of attendance at the Telegraphic Office and at the Meteorological Office, which practically only extend from 8 A.M. till 3 P.M., much time will be lost in sending news of the fact to London. If it commences at 6 P.M. at Valencia, we cannot hear of it in London till 9 A.M. next morning.

On the other hand, if the observer be living in a sheltered spot, such as Plymouth, Nairn, or Greencastle, we shall not get a true report of the gale at all, inasmuch as the observer will not have felt it himself.

The first-named defect in our system can only be met by a considerably increased expenditure on the service, and that is not a scientific, but an administrative question, with which the Government can alone deal.

In order to meet the second difficulty, Mr. De la Rue has kindly devised an instrumental arrangement, by which the fact of any given force of wind having been reached at an exposed point (such as Rame Head for Plymouth, or Malin Head for Greencastle), can be at once conveyed to the reporter in his own office, or even to the central office in London. The instrument has been made by Messrs. Negretti and Zambra.

The following is the construction of the new signalling anemometer.

To the ordinary Robinson's anemometer spindle is affixed a toothed wheel, which is geared with another and larger toothed wheel fixed on a second vertical spindle which carries a centrifugal governor. The governor spindle is made to rotate at one-half or one-third of the velocity of the anemometer spindle in order that the rods carrying the governor balls may not have to be made inconveniently short. A provision is made for adjusting the length of the arms of the governors so that different wind velocities may be indicated within certain limits.

The governor balls act in the well-known way and expand when driven at a given rate, and the upward motion of these governor balls is used to raise a secondary wheel to bring into gear a third spindle on which is fixed the armature of a magneto-electric apparatus, which, like Sir Charles Wheatstone's instruments, consists of a compound permanent magnet with four soft iron cores, two of which are mounted on the north pole of the magnet and two on the south pole; these iron cores are surrounded with fine insulated copper wire, and on rotation of the armature give alternate + and — currents, in rapid succession according to the rate at which the armature is driven. These currents are conveyed inland to the observing station by insulated wires, and give warning by ringing an alarum as long as the anemometer cups are revolving at a velocity sufficient to raise the governor balls so as to bring the magneto-electrical apparatus into gear.

We see, therefore, that by adjusting the governors of the apparatus to indicate any required speed, a warning will at once be given when the wind reaches that speed, be it that of 60, 40, or 20 miles an hour, as may be required.

All the attention which the instrument requires after the apparatus is fixed is to lead two insulated wires from the anemometer into the observing station, and to connect these wires to the two terminals on the alarum.

In order to enable the observer to communicate at once and at as little expense as possible, to London, the fact of the velocity in question having been reached, the individual stations might be known by letters or symbols which might simply be telegraphed to London as an announcement that the alarum was acting at the station in question.

It is obvious that this plan is exceedingly simple, and there seems little reason why it should not be thoroughly efficacious, if only the registering portion of the apparatus can be properly protected from wilful damage by mischievous persons.

As usual, we are met by the question of cost, not only of the apparatus but of the connecting wires, and last, though not least, of the transmission of the messages. To enable us to render our service more effective than it is we must be supplied with the sinews of war. The 3,000*l*. which is the very utmost we spend annually on telegraphy, including salaries, rent, and every item, is but small compared with the 50,000*l*. *entirely exclusive of salaries* with which the chief signal office of the United States is so munificently endowed.

On the Source from which the Kinetic Energy is drawn which passes into Heat in the Movement of the Tides, by John Purser, M.R.I.A., Professor of Mathematics in the Queen's University.

Attention has of late years been directed by Mayer, Prof. James Thomson, and others, to the fact that the friction of the tidal currents on the bed of the ocean exercises an effect in retarding the earth's rotation on its axis.

The late eminent French astronomer, Delaunay, was the first, as far as I am aware, to form a numerical estimate of the possible magnitude of this effect, and to suggest that it furnishes a not

* "An attempt to establish a Relation between the Velocity of the Wind and its Force (Beaufort Scale), with some remarks on Anemometrical observations in General," by Robert Scott, F.R.S. Quart. Journ. of Met. Soc. vol. ii. p. 109.

improbable solution of that part of the secular inequality in the moon's mean motion which remains still unexplained.

He pointed out that inasmuch as the axis of the tidal spheroid is always behind the moon's place, a couple is exerted by the forces of the moon's attraction, which on the one hand retards the rotation of the earth, and on the other increases the dimensions of the lunar orbit.

This alteration of the lunar orbit prevents us from concluding, as we should otherwise do, that the kinetic energy which passes into heat in the movement of the tides has for its exact equivalent a corresponding quantity drawn from the store laid up in the earth's rotation on its axis.

The object of the present communication is to examine whether we can assert such an equivalence to hold approximately, and if so, to what degree of approximation. The question was started some years ago by the Astronomer Royal in the Astronomical Notices for the year 1866.

It occurred to the author that we might arrive at a solution of the problem from the information given us by the equation of energy combined with that of the conservation of angular momentum.

Let us in the first place take the case of a binary system consisting of the earth and moon, but suppose the plane of the earth's equator to coincide with that of the lunar orbit. If Q denote the energy which, during a given interval, passes into heat through tidal action, then, assuming the moon spherical and her rotation consequently unaltered, $Q = -\delta$ (energy of earth's rotation) $-\ \delta$ (energy of lunar orbit). By the energy of the lunar orbit is denoted the kinetic energy of the revolution of the earth and moon round their common centre of gravity, together with the potential energy of their separation.

Now the energy of orbit = constant $- \frac{1}{2}\, m\, m^1\, \mu\, \frac{1}{a}$, where $m\, m^1$ represent the masses of the two bodies, μ the unit of attractive force, and a the mean distance.

Hence $Q = -\delta$ (energy of earth's rotation) $- \frac{1}{2}\, m\, m^1\, \mu\, \frac{\delta a}{a^2}$.

Let h denote the angular momentum of the revolution of the two bodies round their common centre of gravity, H the angular momentum of the earth's rotation, then

$$\delta H = -\delta h$$

but

$$h = \frac{m\, m^1 \sqrt{\mu}}{\sqrt{m + m^1}} \sqrt{a}\sqrt{1 - e^2}$$

$$\therefore\ \delta h = \frac{m\, m^1 \sqrt{\mu}}{\sqrt{m + m^1}}\left\{\sqrt{1 - e^2}\ \frac{\delta a}{2\sqrt{a}} - \frac{\sqrt{a}\,.\,e\,\delta e}{\sqrt{1 - e^2}}\right\}$$

When the excentricity is small the second term in this expression may be shown to be negligible when compared with the first, and we may write

$$\delta H = -\delta h = -\frac{m\, m^1 \sqrt{\mu}}{\sqrt{m + m^1}}\cdot\frac{\delta a}{2\sqrt{a}}$$

$$\therefore\ Q = -\delta\,(\text{energy of earth's rotation}) + \frac{\sqrt{m + m^1}\,.\,\sqrt{\mu}}{Q^{\frac{1}{3}}}\,\delta H$$

Or if I denote the moment of inertia of the earth round her axis,

ω her angular velocity of rotation,

Ω the mean angular velocity of the moon in her orbit,

$$Q = -I\omega\,\delta\omega + I\,\Omega\,\delta\omega$$

$$\therefore\ -I\omega\,\delta\omega = \frac{Q}{1 - \frac{\Omega}{\omega}}$$

The left-hand member represents the loss of energy due to the slackening of the earth's rotation, and as Ω has the same sign as ω, we learn that not only is all the energy Q which is turned into heat in the motion of the tides drawn from the earth's rotation, but that, as a necessary concomitant, additional energy is transferred from the earth's rotation to the store at potential and actual energy, corresponding to the orbital motion of the system.

It also follows that when Ω is small compared to ω [in the actual case $\frac{\Omega}{\omega} = \frac{1}{27}$ nearly], the energy so transferred bears a very small ratio to Q, and that the energy lost in the earth's rotation is almost the exact equivalent of that consumed in tidal friction.

Let us now consider the case which we actually have to deal with, where the plane of the earth's equator does not coincide with the plane of the orbit.

Let G represent the resultant angular momentum of the system which will be fixed in magnitude and in direction.

θ, Θ the angles which the planes of h and H make with the plane of G.

Then, since $H^2 = G^2 + h^2 - 2\,G\,h\cos\theta$

$$H\,\delta H = (h - G\cos\theta)\,\delta h + G\,h\sin\theta\,\delta\theta$$

$$\therefore\ H\,\delta H = \frac{m\, m^1 \sqrt{\mu}}{\sqrt{m + m^1}}\left\{(h - G\cos\theta)\frac{\delta a}{2\sqrt{a}} + G\sqrt{a}\sin\theta\,\delta\theta\right\}$$

$$\text{Or, } \delta H = \frac{m\, m^1 \sqrt{\mu}\sqrt{a}}{\sqrt{m + m^1}}\left\{-\cos(\Theta + \theta)\frac{\delta a}{2a} + \sin(\Theta + \theta)\,\delta\theta\right\}$$

The author proves from a calculation of the disturbing reactionary forces exercised by the tidal protuberances that the variations $\delta\theta$ and $\frac{\delta a}{2a}$ are of the same order of magnitude, although their exact ratio cannot be determined without far more complete data respecting the tides than we at present possess.

Let the ratio of the first of these variations to the second be denoted by λ, then

$$\delta H = -\frac{m\, m^1 \sqrt{\mu}}{\sqrt{m + m^1}}\left\{1 - \lambda\tan(\Theta + \theta)\right\}\frac{\delta a}{2\sqrt{a}}$$

$$\therefore\ -I\omega\,\delta\omega = I\left\{1 - \frac{\Omega}{\omega}\ \frac{\sec(\Theta + \theta)}{1 - \lambda(\tan\Theta + \theta)}\right\}^{-1}$$

We may therefore still infer that since Ω is small compared to ω, the energy lost in the earth's rotation is almost the exact equivalent of that consumed in tidal friction.

The same conclusion manifestly applies to the work done by a tide-mill or any other mechanism in which the tides furnish the motive power.

It would further appear that as the mean value of $\tan(\Theta + \theta)$ is less than $\frac{1}{2}$, and that of λ cannot, on any probable hypothesis of the position of the tides, be supposed to exceed unity, the coefficient of $\frac{\Omega}{\omega}$ in the above expression is positive. Hence we may conclude that, as in the simpler case previously discussed, the small transfer of energy which accompanies the principal action takes place from the earth's rotation to the moon's orbit.

All these conclusions apply *mutatis mutandis* if we regard as our binary system the earth and sun.

In the case of nature, where we have to consider the three bodies acting together, the main conclusion that all the energy lost in tidal friction is drawn from the earth's rotation will not be invalidated.

Moreover, if we assume, as is generally done, that the friction varies as the velocity, the lesser effect, *i.e.* the concomitant, transfers its energy from the earth's rotation to the energy of the orbit of the moon about the earth, and that of the earth about the sun will correspond to the values separately calculated for the binary systems.

On the construction of large Nicol's Prisms, by W. Ladd.—In January 1869 I constructed two Nicol's prisms of about $2\frac{1}{2}$ in. aperture, which in the able hands of Mr. W. Spottiswoode and Dr. Tyndall have done much valuable work, and given rise to a great demand for such prisms, both in England and America; but as the length of a good Nicol should be about three times its diameter, very great difficulty is experienced in procuring pieces of spar of sufficient purity to give such a field.

This has given rise to various methods of utilising the spar by building up prisms of shorter pieces and combining them in such a way as to unite their field of view, such as utilising four prisms of 1 in. aperture, thus giving an aperture of 2 in. Another plan I adopted was to unite two whose diameter in one direction was double that of the other; these, being balsamed together, made a very good prism; but lately I had a very good piece of spar that, but for one corner of the rhombus, which was bad, would have made a prism $3\frac{1}{4}$ in. aperture. This was, therefore, too valuable a piece to be put aside.

I therefore cut it at the proper angle, which took away all the bad portion; I then took another piece half the length of the first, but of the same diameter, and cut this also at the proper angle, and the bringing the two ends together gave me another complete half; these, having been balsamed together and united with the first half, produced a perfectly good prism. I may add that it is essential that the two or more pieces constituting the half prism should have their cleavage planes exactly parallel, or the image would be bent at their junction.

SECTION B—Chemical Science

On the Specific Volumes of certain Liquids, by Prof. Thorpe.—Kopp found that the specific volumes of certain elements varied. Thus, the specific volume of oxygen "within the radicle" = 13·2, "without the radicle" = 7·8; of sulphur, "within the radicle" = 28·6, "without the radicle" = 22·6. "Within the radicle" was defined as meaning an instance where the oxygen or sulphur atom is united by *two* bonds to the binding element, while upon "without the radicle" it is united by only *one* bond. Kopp announced that members of the same chemical family have identical specific volumes. The author determined the specific volumes of vanadyl trichloride, $VOCl_3$, and phosphoryl trichloride, $POCl_3$, and found in the former case that the specific volume = 106·5, while in the latter it = 101·5. Kopp's law does not therefore hold in this instance. The following examples also show that as the atomic weight increases the specific volume also increases:—

$SiCl_4$ . . . . . specific volume = 121·1
$TiCl_4$ . . . . . " " = 125·1
$SnCl_4$ . . . . . " " = 132·4

Another of Kopp's deductions is that isomers have the same specific volume; but the author found a difference between the specific volumes of ethyl-amyl and heptane, both of which are expressed by the formula C_7H_{16}; in the former case the number was 162·25, while in the latter it was 157·34. The author also determined the specific volume of the compounds PCl_3 = 93·7, $POCl_3$ = 101·5, and $PSCl_3$ = 116·3. Now, 101·5 − 93·7 = 7·8; that is to say, the specific volume of oxygen in $POCl_3$, is 22·6, hence it is without the radicle in this compound. So also 116·3 − 93·7 = 22·6; that is, the specific volume for sulphur "without the radicle." Hence the structural formula of these two substances $POCl_3$ and $PSCl_3$ will be

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  Cl
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Cl—P—O—C
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land

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  Cl
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Cl—P—S—Cl
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respectively; that is, in each case phosphorus is most probably a triad, not a pentad element.

On the Dissociation of Nitric Acid, by Messrs. Braham and Gatehouse.—Nitric acid when passed through an ordinary clay pipe at varying temperatures is split up: at the temperature of molten tin 2·10 per cent. is decomposed; at the temperature of molten lead 22 to 23 per cent. is decomposed; when the clay pipe is heated with gas 71·72 per cent. is decomposed, while when heated with charcoal 83·4 per cent. is decomposed. The gases evolved consist of oxygen, nitrogen, and nitrous oxide; the proportion of these gases it has been found very difficult to determine accurately. The following probably represents the reaction which takes place at minimum temperatures:—

$$8HNO_3 = 4NO_2 + 4H_2O + N_2O + N_2 + O_{11}.$$

When glass bulbs are partially filled with nitric acid and exposed to direct sunlight, the acid is decomposed, the amount varying with the time and intensity of the light; the decomposition is brought about by the violet end of the spectrum. If the bulbs are entirely filled with nitric acid, no decomposition ensues. After some time the decomposition ceases; this is due to the formation of nitrous acid, and if this is expelled by boiling, the decomposition again proceeds. If pure nitric acid be boiled, even to dryness, no decomposition takes place, but if the acid contains nitrous acid, then this latter is dissociated.

On the Replacement of Organic Matter by Siliceous Deposits in the process of Fossilisation, by Dr. Carpenter, F.R.S.—The author described several cases in which the internal casts of *Foraminifera* were found, consisting of silica, generally as silicate of iron. This process is now going on at the ordinary sea-bottom. Fragments of the spines of *Echinæ*, which originally contained protoplasm, have been found, in which the organic matter has been entirely replaced by silica, thus forming exact siliceous models of the animal matter. In some cases the siliceous deposit has preserved the exact form of thin tubes less than 1-10000th of an inch in diameter. The author supposed that during the gradual decay of the animal matter there had occurred a simultaneous deposition or substitution of siliceous matter in its stead.

On the Silicified Rock of Lough Neagh, by Prof. Hodges.—The water of Lough Neagh was found to contain only 12·95 grains of solid water per gallon; of this, 10·6 grains consisted of mineral matter, while 2·35 grains of organic matter were present. Of the total mineral salts a very small quantity only—less than 1 grain per gallon—consisted of ferric oxide. Samples of petrified wood were also examined: these contained on an average about 87 per cent. of silica, and a very small percentage of iron.

On a Self-registering Apparatus for measuring the Chemical Intensity of Light, by Prof. Roscoe, F.R.S.—In this communication the author described his already well-known self-registering photo-chemical apparatus.

On certain Abnormal Chlorides, by Prof. Roscoe, F.R.S.—The author drew attention to some of the chlorides of vanadium, tungsten, uranium, and sulphur. The highest chlorides which we have been able to obtain of these elements generally do not correspond with the highest oxides; thus, although we know of the oxides V_2O_5, we know of no higher chloride than VCl_4, and even this chloride is easily decomposed into VCl_3 and free chlorine. Although the oxide of tungsten, WO_3 is stable, yet the corresponding chlorine WCl_6 is very ready to split up into WCl_5 and free chlorine. So also UO_3 is a well-known oxide of uranium, yet until lately UCl_4 was the highest known chloride. The author has recently succeeded in preparing the penta-chloride UCl_5, which occurs as a light brown powder, and also as darker acicular crystals. Again, we have SO_2 and SO_3, but it is only very lately that SCl_4 has been obtained, and the compound is so unstable as to undergo dissociation at very low temperatures.—Dr. Debus suggested that the equivalency of many of the elements depends upon the element or elements with which they are united, and that hence these and other anomalous results.—The President remarked that he did not see why we should not expect to meet with examples of change of atomicity; that if we always found elements exhibiting an even, or always an odd number of atomicities, this was very remarkable, and called for explanation, but that we should not be surprised to meet with exceptions to the rule; indeed, that we could form no distinct physical idea of what we mean by "bonds of atomicity." He remarked that we cannot well use oxygen as a measure of atomicity, from the tendency which it so often exhibits of running into chains.

SECTION D—Biology

Department of Zoology and Botany

Dr. Moore called attention to a monstrous state of *Megacarpæa*, and also to a monstrous state of *Sarracenia*; after which he exhibited specimens of grafted roots of mangold wurzel, illustrating the transmission of special characters from the graft to the stock.

Mr. E. R. Lankester read a paper *On the genealogical import of the external shell of Mollusca*, in the course of which he referred to what has been called the recapitulation hypothesis, according to which all living things in their development present a rapid series of pictures or dissolving views of their ancestors, arranged in historical order. Applying this to the human race, he said that the earliest commencement of a human being was a small speck of protoplasm of mucus-like consistency, such as existed in ponds. A later stage exhibited him as a small sac, composed of two layers of living corpuscles, which he inherited from polyp-like ancestors, and was to-day seen in polyps. Still later he was an elongated creature, with slits in the side of the neck, which, like the gill-slits of a shark, he inherited from a shark-like ancestor. Six months after birth the child continued to inherit qualities from its ancestors, viz., from those which crawled on four legs; and at a later period certain irrepressible tendencies made it clear that qualities were inherited from climbing and shrieking animals. Mr. Lankester then went into an elaborate description of certain molluscs with a view of showing that the pen of the cephalopod is homologous with the shell of the lower Mollusca.

Prof. Huxley thought that the position had been well established. Mr. Lankester's attempt to reduce to one form the immense variety of shells in molluscous animals was exceedingly important.

Dr. Carpenter also said that he was almost prepared to receive the conclusion at which Mr. Lankester had arrived.

Dr. M. Foster added his testimony to the value of Mr. Lankester's observations, and said that part of the work accomplished was due to the establishment of the zoological station at Naples.

Mr. W. Archer read a paper *On a new form of Protozoa.*

Prof. Cunningham contributed a short paper *On two Species of Crustacea*, one belonging to the remarkable fresh-water genus, the *Atya spinipes*, and the other belonging to an apparently undescribed species of the genus *Pontonia*, which are remarkable for being found as tenants of the shells of living bivalve molluscs. The two specimens were found in the Singula Archipelago.

A paper, contributed by Mr. T. Lister, *On the Spring Migrating Birds of North England*, was read by Prof. Cunningham.

Mr. E. R. Lankester brought the subject of *English Nomenclature in Systematic Biology* before the department, and said it would be a considerable gain to science if there could be introduced a series of terms distinctly English in their etymology, which would be accepted as authoritative and used throughout the country. The only question was whether it was possible, by any action on the part of scientific men, to introduce such a series of terms. He suggested the appointment of a committee of men whose names would be received as authoritative throughout the country, to draw up a list of terms which should be used for the groups of the animal and vegetable kingdom.

A discussion followed, in which Prof. Thiselton Dyer, Mr. Bentham, Mr. A. W. Bennett, Prof. Cunningham, Miss Becker, Prof. Dickson, and Dr. Sclater took part, the generally expressed opinion being unfavourable to the change proposed.

A paper was read by Mr. H. Airy *On a peculiar form of Leaf-arrangement.*

SCIENTIFIC SERIALS

Justus Liebig's Annalen der Chemie, Band 172, Heft 3.—This part contains the following papers:—Communications from the chemical laboratory of Greifswald.—86. On metatoluidine, by F. Lorenz. The author describes the preparation of this substance. Paratoluidine is first treated with acetic anhydride, and para-acettoluide thus obtained, which, by treatment with nitric acid, yields metanitropara-acettoluide. By heating with alcoholic potash this latter substance is converted into metanitroparatoluidine; this last body is acted on by nitrous acid, and the diazo-compound treated with alcohol leaves metanitrotoluol, which, by reduction with tin and hydrochloric acid, gives metatoluidine. Several of the salts of this base are described, likewise the conjugate sulpho-acids, dibrominated substitution derivatives, &c.—87. Note on the quantitative determination of paratoluidine in presence of orthotoluidine, by the same author.—88. On metabromorthosulphotoluic acid, by Dr. E. Weckwarth. The preparation of this acid, which possesses the formula $C_6H_2\left\{\begin{matrix}CH_3\\ SO_3\\ Br\\ N\end{matrix}\right\rangle N$ is described. The potassium, sodium, barium, strontium, copper, and lead salts have been analysed, and the chlorine, amido, and nitro substitution derivatives examined.—89. On orthoamidoparasulphotoluic acid, by Dr. M. Hayduck. The barium and lead salts are first described; the brominated acid and its potassium, barium, and lead salts are next treated of. The amido acid distilled with potassic hydrate gives off ammonia, and aniline and a potassium salt of anthranilic acid, $C_6H_3\left\{\begin{matrix}H\\ NH_2\\ COOK\end{matrix}\right.$ is obtained. With hydrochloric acid and potassic chlorate the amido acid yields trichlororthotoluquinone, $C_6\left\{\begin{matrix}CH_3\\ O_2\\ Cl_3\end{matrix}\right.$, from which the corresponding hydroquinone has been obtained. By the action of bromine on the amido acid a dibrominated acid is obtained, of which the barium salt has been analysed. Diazo-orthoamidoparasulphotoluic acid, $C_6H_3\left\{\begin{matrix}CH_3\\ N\\ SO_3\end{matrix}\right\rangle N$, obtained by the action of nitrous acid on the amido acid, is next treated of. This body acted on by water gives orthocresolparasulphonic acid. The nitro-diazo acid is finally described.—90. On a new nitro-toluidine, by Dr. O. Cunerth.—On paramido-orthosulphotoluic acid, by Dr. F. Jenssen. The nitro-acid, $C_7H_6(NO_2)SO_3H\,.\,2\frac{1}{2}H_2O$, and several of its salts are described, also the chloride and amide. The amido acid is then treated of, likewise its salts and substitution derivatives.—On some decompositions of pyroracemic acid, by Dr. C. Böttinger. This lengthy memoir is divided into three sections: the first treats of the decomposition of the acid in acid solutions, the second of its decomposition in alkaline solutions, and the third of its decomposition *per se*. Among other things the author describes in great detail the preparation and properties of uvic acid and its salts.—On acenapthene and naphthalic acid, by Arno Behr and W. A. Van Dorp. The authors have examined several of the salts of the acid, its methylic ether and anhydride. The constitution of the two bodies is also discussed.—Researches on the volume constitution of solid bodies, by Dr. H. Schröder.—K. Helbing contributes a paper on an examination of some benzene liquors, and one entitled "Research on a new earth resin." This resin is found in large masses in a stone quarry at Enzenau, between Tölz and Heilbrunn. Nineteen per cent. of the resin is soluble in ether, and nine per cent. in ether and hot alcohol. The insoluble portion contains iron pyrites and a hydrocarbon of the formula $C_{40}H_{62}$. The ethereal extract contains a substance of the formula $C_{40}H_{62}O_2$, melting at 192°. The hot alcoholic extract gave a substance of the composition $C_{40}H_{60}O_8$.—On cymene, by F. Fittica. The author establishes the identity of the cymenes from camphor, ptycholisol, and thymol, and furnishes evidence that the propyl contained in the cymenes is normal propyl. The isomeric oxy- and thio-cymenes are also treated of.—The constitution of benzene, by A. Ladenburg.—On derivatives of phloretin, by Hugo Schiff. The author treats of the preparation of phloretin, of phloretic acid, and phloroglucin, likewise of phloroglucide and of triphloretide. The present part contains the index for vols. 169, 170, and 171.

Zeitschrift der Œsterreichischen Gesellschaft für Meteorologie, Aug. 15.—Dr. H. Wild contributes to this number some suggestions for the consideration of the Permanent Committee of the International Congress on the question of the establishment of an International Meteorological Institution. Before the Congress at Vienna he was altogether in favour of the scheme, but now feels persuaded that one institution could hardly exercise the large functions proposed with advantage. The difficulty of directing from one spot a number of stations scattered over the globe would be great, the conditions of these stations would not be familiar, the construction of isobaric charts, &c., could only be undertaken with exact data and co-operation of the central national offices, and the modification of instruments, &c., would not be a proper task to be attempted at any one place, with its narrow range of climatic conditions. The failure of one of the central offices would cripple the results produced by the Institution, and, besides, the energetic working of these offices would be endangered if they were to delegate some of their present problems to the Institution. The national offices which now occupy themselves with general meteorology might bestow too much attention to local matters. These objections would be avoided if each central office were to attend specially to some branch of the meteorology of the globe mutually agreed upon; for instance, one to the preparation of synoptic charts, another to rainfall, and so forth. The results of the various lines of research could then be interchanged, and the failure of one office would not damage the work of the others. The establishment and maintenance at common expense of international stations proper in uncultivated countries, and the publication of their observations, Dr. Wild holds would be best undertaken by the countries to which these stand in the nearest relation. There would remain, then, for the Institution the work of interchanging the results and keeping up the relations of central offices, the arrangement of occasional Congresses, questions concerning instruments, and the like.—Among the *Kleinere Mittheilungen* we observe an abstract of the important report of Mr. Blanford to the Government of Bengal for the year 1873.

Poggendorff's Annalen der Physik und Chemie, No. 5, 1874.—In 1868 Prof. von Rath published some observations on a form of silica to which he gave the name Tridymite. It always crystallises in twin hexagonal prisms, and has a low specific gravity. His further observations show lines of division between the elements forming the twins, and in these lines the third crystal in tridymite is developed. There is a similar persistence of the division plane between crystals of humite, and analogous triple crystals in anorthite, and an interlacing of crystals in leucite; and he concludes that while two crystals cannot be united to each other in many crystal groups, yet they can be united to a third crystal. Fine specimens, three millimetres long, reaching him from the trachytes of Pachuca in Mexico, he has made full measurements. The crystals, however, are generally of small size relatively to the accompanying minerals. They commonly occur in drusy cavities of the trachytes associated with specular iron, hornblende, and augite. Details are given of the mode of growth of the twins, their various forms and intimate combinations.—Another paper by the same author describes a remarkable crystal of calc-spar from Lake Superior. It is shown by the formulæ of the faces to be a form which is distinct from any hitherto observed. It is transparent, and occurs with native copper in amygdaloid melaphyre.—Another paper by Von Rath is on a singular combination of rutile and specular iron. The fine spiculæ of rutile are developed from between the plates of a red kind of specular iron, and may be a subsequent formation. It occurs in association with crystals of quartz and adularia in clefts or druses in a fine grained talcose gneiss.—Von Rath's next paper is On remarkable artificial crystals of pure copper. At the meeting last year of the German Geological Society at Weisbaden, Prof. v. Seebach exhibited crystalline copper which Prof. Senft of Eisenach had obtained by galvanic electricity between small rings of zinc and copper. From an aggregation of very small crystals a large mass was formed of the size of four millimetres. The crystals are always twins, with the free end most produced, and have a form which has not heretofore occurred in native copper, though it has been found in galena and binnite. The octahedral faces of the crystals are flat and shining, while those of the icositetrahedron are curved and less perfect.—Another paper discusses the hypersthene of Mont Dore, described by Des Cloizeaux, a mineral which there occurs in druses in trachyte in crystals three millimetres long, associated with crystals of sanidine and tridymite.—Von Rath's last memoir describes a new zeolite, named foresite, from the tourmaline granite of Elba.—Prof. Th. Petruschevsky, of St. Petersburg, who has devoted himself since 1862 to the phenomena of magnetism, now publishes the results of his investigation on the direct and indirect determination of the pole in magnets. Starting with the basis of Biot's curve of magnetic intensity, he points out that it is as easy to determine the pole theoretically as empirically, details his two methods, and the apparatus wherewith they are tested. He then considers the determination of the pole in electro-magnets, and finally enumerates results.—Dr. Gustav Junghann explains a simple law for the development and grouping of crystal zones. He introduces some maps of anorthite into the memoir, in which the formulæ of the faces are all set down in tabular form in square spaces.—Herr G. Hagen contributes a memoir On the resistance offered by the air to plane discs moved through it.—Herr J. J. Müller examines one of the Hamiltonian theories of movement which underlies the principles of mechanics.—Herr von Laspeyres has an interesting experimental paper On the existing and a new thermostat, and Herr Rammelsberg describes the crystalline form and modifications of selenium.—The most interesting reprinted paper is Terquem's account of the vibroscope for accurately determining number of vibrations.

SOCIETIES AND ACADEMIES

LEEDS

Naturalists' Field Club and Scientific Association, Sept. 15.—Mr. Edward Thompson, vice-president, in the chair. —Mr. James Abbott mentioned that he had gathered *Butomus umbellatus* in flower at Kirkstall, on Sept. 12. The plant had not been noted in the Leeds district for upwards of twenty years past, when it grew in the stream at the foot of Woodhouse Ridge. —Mr. Henry Pocklington, in conjunction with Mr. James Abbott, demonstrated the action of the induced current upon the protoplasmic gyrations in the cells of *Vallisneria spiralis*, by means of a simple electric slide and a small inductorium. The effect produced was very marked. The circulation of the protoplasm stopped almost instantly. It was, in fact, as was described by one of the members, as though a strong "break" were put on. The protoplasm was corrugated by the rapid contractions induced, and the results taken altogether were of the most interesting character. Mr. Pocklington will probably communicate a more complete description of his apparatus and its results at an early date.

PARIS

Academy of Sciences, Sept. 21.—M. Bertrand in the chair.—The following papers were read:—Note on barium sulphocarbonate, by M. P. Thenard. Since M. Dumas' proposal to use sulphocarbonates for the destruction of *Phylloxera* these salts have acquired a new interest. The barium salt is easily prepared by agitating a strong solution of barium sulphide with carbon disulphide. The author describes a process for manufacturing this salt on a large scale, and proposes to turn his attention to the manufacture of the potassium salt.—On a new mercury pump, by M. de Las Marismas. This apparatus is stated to cost 35 francs, and to exhaust a receiver of six litres' capacity to one millimetre pressure in four minutes; all pressures from that of the atmosphere up to an absolute vacuum can be obtained, the gas contained in the receiver can be collected if necessary, and a vacuum can be preserved indefinitely.—On the action of alimentary or medicamental liquids on tin vessels containing lead, by M. Fordos. The author has tried the action of wine, vinegar, lemonade, &c., upon hospital vessels containing 10 per cent. of lead; this latter metal was invariably found in the fluids used, and the author concludes that the use of this alloy may be attended with great danger.—Researches on the colouring matters of garancine, by M. A. Rosenstiehl. The colouring materials of garancine—alizarine, pseudopurpurine, purpurine, and its hydrate—have all been investigated in great detail by the author. Purpurine and its hydrate are formed at the expense of pseudopurpurine; the products of the reduction of purpurine have been studied, and two isomers of this body obtained, one of which has been prepared by synthesis starting from benzoic acid. Pure alizarine is prepared by heating the commercial substance with water to 200° C. for some hours, a small quantity of caustic alkali being added. Impurities are totally destroyed by this treatment, and the product of the operation is further purified by frequent crystallisations. Pseudopurpurine is a very unstable body; heating with water or alcohol transforms it into a mixture of purpurine and its hydrate. From the present researches it seems that garancine red and the rose colouring matter yielded by garancine flowers cannot be obtained from alizarine alone; the presence of purpurine or its hydrate is indispensable. The product of the action of reducing agents on purpurine and its hydrate is purpuroxanthine, an isomeride of alizarine.—New experiments on the nature of the sulphuretted principle of the waters of Luchon, by M. F. Garrigou. This is a reply to a paper by M. Filhol in the *Compt. Rend.* for Sept. 7.—Observations relating to a recent communication by M. Lichtenstein on some points in the natural history of *Phylloxera vastatrix*, a letter from M. Balbiani. The author again enforces his views as to the non-identity of the *Phylloxera* of the vine and of *Quercus coccifera*.—M. P. Thenard made known to the Academy the measures adopted by M. le Préfet de Saône-et-Loire on the approach of *Phylloxera*.—M. le Ministre de l'Agriculture et du Commerce and M. le Ministre des Finances consulted the Academy on the employment of tobacco juice for the destruction of *Phylloxera*.—Communications relating to *Phylloxera* were also received from MM. J. Bond, H. de Martiny, R. Delpit, &c.—Properties of the "implexes" of surfaces defined by two characteristics, a geometrical note by M. Fouret.—On luminous diffusion, by M. A. Lallemand.—On Warwickite, by M. J. Lawrence Smith. The author assigns to this mineral the formula $\dot{M}g_5\dddot{B}_3 + (\dot{M}g\dot{F}e)\ddot{T}i_2$.—On the *rôle* played by gases in the coagulation of blood, by MM. E. Mathieu and V. Urbain.—On the movement in the bilabiate stigmata of the Scrophulariaceæ, Bignoniaceæ, and Sesameæ, by M. E. Heckel.—Observation of a bolide at Versailles on the evening of the 14th of September, by M. Martin de Brettes.

CONTENTS

ERRATUM.—Vol. x. p. 416, col. 1, line 22 from bottom, for "Norway" read "Moray."