as regards the shape of their tendons. Just along outside the muscles are dark lines more or less well finished, and resulting from the action of the muscles. *Ubi irritatio ibi affluxus.* I believe that it would not be unphilosophical to conclude that a powerful action in the development of the muscles is, in such a case, the cause of a greater combustion or oxidation in the neighbouring parts. In fact, on the head of a Cicada and on the abdomen of an Æschna we find similar patterns, in some way mostly representing the underlying muscles. In the Gomphina the fact is striking, and far more as the stronger species mostly possess a large dark pattern. There are some very small species which are almost entirely yellow; there are no small species entirely black.

Should the fact, with the explanation, be admitted, a step farther in the explanation of the different patterns would be made. I know very well that in the Odonata there are patterns which do not agree with my explanations, even some contrary to it; but if some certain facts be explained, there are perhaps more factors still unknown or unobserved. The explanation for certain facts would still be admissible, or at least not entirely objectionable.*

The patterns on the wings and elytra could not be the product of the action of muscles, but I believe it to be probable that the sudden rush of blood, or even air, by the accelerated circulation and respiration in the act of transformation may have the same effect. In this way some patterns, otherwise not explicable, could be understood. The eyespots in the caterpillars of some Papilionidæ have been ascertained by Leydig to be epidermal colours, and I believe that the various kinds of eyespots in the wings of the imago are also epidermal colours. If a stream of blood meets a small obstacle just in the centre, a funnel is formed; if this obstacle is a ring, and behind it another obstacle, we have two or more funnels, one in the other, and the section of them will be circular or elliptical according to the angle at which they reach the surfaces. Such patterns in the elytra and wings are formed or preformed at the time when the wing is a sac; sometimes before the transformation, and here is another circumstance which explains some patterns. The walls of the sac are suddenly augmented and strongly dilated in the transformation. Small patterns performed in the sac will also be altered and enlarged by the same process, and I know that many patterns of Lepidopterous wings are in such a way very easily explained All the waved lines of the wings and other marks belong here. and as the ribs or nervures seem to grow faster in transformation, the waved appearance would be explained In fact the greater part of the patterns seem to be produced by expansions or distraction of the pattern performed in the wing at some period before the transformation. H. HAGEN

SCIENTIFIC SERIALS

THE *Monthly Microscopical Journal* for October 1872, contains a continuation of Dr. Robert Braithwaite's papers on bog mosses, the present communication being confined to *Sphagnum neglectum* Angstr. Dr. J. J. Woodward contributes a reply to further remarks on Tolles' $\frac{1}{8}$th and Powell and Lealand's $\frac{1}{16}$th. This is succeeded by a communication "On the History, Histological Structure, and Affinities of *Nematophycus Logani* Curr. (*Prototaxites Logani* Dawson), an Alga of Devonian Age," by Wm. Carruthers, F.R.S., in which the author combats the theory advanced by Dr. Dawson, that the fossil in question is coniferous, and contends that it is cryptogamous, belonging to a gigantic alga, of the class *Chlorospermeæ*. Two plates accompany this very interesting and important communication —"On the active part of the Nerve Fibre, and on the probable nature of the Nerve Current," by Lionel S. Beale, F.R.S., is a further contribution to the researches for which Dr. Lionel Beale has earned a reputation.—"On the Regeneration Hypothesis," by Dr. Louis Elsberg, of New York. The fundamental proposition of this hypothesis is thus stated by its author: "The germ of every derivative living being contains plastitudes of its whole ancestry."—Dr. J. J. Woodward contributes some observations on the use of monochromatic sunlight, as an aid to high-power definition.—A short paper by Prof. Albert H. Tuttle, on one of our common monads is from a communication made to the microscopical section of the Boston Society of Natural History.

Bulletin de l'Académie Royale de Belgique, No. 8. This number contains a mathematical paper of some length, by M. P. Mansion, on singular solutions of differential equations of the first order; also a note by M. Dubois describing some researches on the camphors. He studied the action of pentasulphuret of phosphorus at a high temperature on monobromated camphor, and found that it gave cymol, accompanied with small quantities of hydrocarbons of the same homologous series, and an organic sulphhydrate soluble in alkalies. M. Alphonse Waters gives a sketch of some efforts that were made in Belgium in the middle of the 17th century towards the establishment of free trade.—A note by M. Schuermanns treats of the discovery of objects of amber in Belgium, the writer advising a special study of the circumstances which may have connected Belgium with the commercial route from Etruria to the country of amber, on the Baltic.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, Dec. 5.—"Colouring-matters derived from Aromatic Azodiamines." II. Safranine. By Drs. A. W. Hofmann, F.R.S., and A. Geyger.

Whilst we were engaged with the study of the blue colouring-matters produced by the action of aromatic monamines on azodiphenyldiamine, our attention became directed to a beautiful red tar-pigment, which has been known for some time by the commercial name of Safranine, being extensively used as a substitute for safflower in dyeing silk and cotton. Safranine has not as yet been minutely examined; but, as far as can be judged from the scanty information we possess regarding its production, it is scarcely doubtful whether this important dye must be looked upon as being the derivative of an azodiamine. The analyses of safranine thus promised to throw considerable light upon the nature of the compounds under examination.

Saframine occurs in commerce either as a solid body or *en pâte.* In the solid state it forms a yellowish-red powder, in which, together with considerable quantities of chalk and common salt, the chlorhydrate of a tinctorial base has been recognised. The pure dye may be easily separated from the crude safranine. It is only necessary to exhaust the commercial product with boiling water; on cooling, the filtrate deposits a slightly crystalline substance, which, after several recrystallisations from boiling water, leaves no residue on ignition. During these operations, however, the salt undergoes perceptible alteration; with every recrystallisation it becomes more soluble and less crystalline. These alterations depend upon the separation of chlorhydric acid from the salt. In fact the percentage of chlorine is found to diminish in the product of succesive crystallisations; thus the product of the third contained 8·48 per cent. that of the fourth crystallisation only 7·46 per cent. Addition of chlorhydric acid to the mother-liquors at once reproduces a crystalline precipitate. This instability of the chlorhydrate, and, in fact, as may even now be stated, of the salts of safranine in general, has very considerably impeded the study of this body, and often materially affected the accuracy of the analytical results. In order to obtain the normal salt, the boiling liquid during the last crystallisation had always to be acidified with chlorhydric acid.

"Synthesis of Aromatic Monamines by Intramolecular Atomic Interchange." By Dr. A. W. Hofmann, F.R.S.

In a paper submitted to the German Chemical Society about a year ago, we proved (Dr. Martius and myself) that the action

* So far as I know the literature relating to the phenomena of mimicry, all these related differences are often confused, and I believe that in separating them and following the views above given, many facts would be better understood, and this interesting subject more easily advanced.

Besides all the difficulties which oppose a clear and correct view, there is one more which I do not find mentioned, *i.e.* the so-called colour-blindness, and the different degrees of it. Prof. B. A. Gould in his excellent work, "Investigations on Anthropological Statistics of American Soldiers," has given attention to it in a very remarkable chapter. Persons who cannot distinguish ripe cherries upon the tree, or strawberries on the vine by their colour, are far more numerous than would be suspected. Serious misunderstandings, and even calamities, have been reported in the army, resulting from mistakes in the colour of green and red light by officers of the signal corps. He gives the statement that usually one in twenty, and in the soldiers examined one in fifty, was subjected to colour-blindness. But these numbers show only the extremes; and it is easy to believe that a much greater number are more or less affected with it. In fact, we have no means of measuring this physiological difference; if two persons call something green, and even compare the colour with certain known objects, there is no proof at all that they see just the same colour. I think that it would be prudent in describing cases of mimicry, especially when they are extraordinary, not to forget that even the best observer may be unaware of this infirmity, and in fact the best authorities on colour-blindness always state that the greater number of persons have no idea of their infirmity.

of methylic alcohol on aniline chlorhydrate at a high temperature and under pressure, far from yielding exclusively methyl- and dimethylaniline, as has been formerly believed, is capable of causing methylation of the phenyl group, and thus producing quite a series of higher homologues of dimethylaniline.

If we endeavour to gain an insight into the mechanism of this reaction, we are led to assume that in the first instance the chlorhydric acid of the aniline salt gives rise to the formation of methylic chloride, which in its turn induces substitution, first in the ammonia fragment, and ultimately in the phenyl group itself. If, on the other hand, we remember that a tertiary monamine, such as must be formed by the final methylation of the ammonia fragment in aniline, when submitted to the action of an alcohol chloride, is invariably converted into an ammonium compound, it must appear rather strange that in the process above alluded to only tertiary, and never any quaternary bases are observed.

Under these circumstances the idea very naturally suggested itself of submitting the behaviour of quaternary compounds at a high temperature under pressure to an experimental investigation.

The simplest compound that could be detected for such an inquiry appeared to be trimethylphenylammonium iodide.

$$C_6H_5 . CH_3 . CH_3 . CH_2NI.$$

Reserving for a future communication the experimental details of this inquiry, I will limit myself for the present to a brief statement of the principal result obtained.

Leaving secondary reactions out of consideration, the transformation of the trimethylated phenylammonium iodide is represented by the following equations :—

Transformation of quaternary into tertiary compound.

$$C_6H_5 . CH_3 . CH_3 . CH_3 . NI = (C_6H_4 . CH_3)CH_3 . CH_3 N . HI.$$

Transformation of tertiary into secondary compound.

$$(C_6H_4.CH_3).CH_3.CH_2.N.HI = [C_6H_3(CH_3(CH_3)_2]CH_3.HN.HI$$

Transformation of secondary into primary compound.

$$[C_6H_3(CH_3)_2]CH_3 . HN = [C_6H_2(CH_3)_3]HHN . HI.$$

Accordingly trimethylated phenylammonium iodide, when submitted to the action of heat, is transformed in the first place into iodhydrate of dimethylated methylophenylamine or dimethyl toluidine; this, in a second phase of the reaction, becomes iodyhdrate of monomethylated dimethylophenylamine, or xylidine, which in its turn is ultimately converted into iodhydrate of trimethylophenylamine, *i.e.* of cumidine. The essential character of the reaction is thus seen to be an intramolecular change in the position of the methyl groups. According to the duration of the process, there are incorporated in the benzol nucleus, first the methyl group of the alcohol iodide, and then successively the two methylic groups which are stationed in the ammonia fragments. The action of heat on the quaternary ammonium compound thus places at our disposal a simple means of rising from the benzol series itself to the toluol-, xylol-, and cumol series, or, generally (for the reaction may probably be utilised in many other cases), of passing from a less carbonated to a more carbonated series of compounds.

"New Method for producing Amides and Nitriles." By E. A. Letts, Berlin University Laboratory.

"Investigation of the Attraction of a Galvanic Coil on a small Magnetic Mass." By James Stuart.

Geological Society, Nov. 20.—Prof. P. Martin Duncan, F.R.S. vice-president, in the chair.—"On the Geology of the Thunder Bay and Shabendowan Mining Districts on the North Shore of Lake Superior." By H. Alleyne Nicholson, M.D. The author described the general characters of Thunder Bay, which is almost landlocked on the south-east by the bold promontory of Thunder Cape and a series of islands which form a continuation of this. The rocks immediately surrounding Thunder Bay belong to the "Lower and Upper Copper-bearing series" of Canadian geologists. The author described the general characters of Lake Shabendowan, and stated that from the foot of the lake for about 15 miles westward there is a succession of trappean rocks, beyond which, to the head of the lake, distant 13 miles, the country is occupied by Huronian slates like those between the lake and Thunder Bay. These slates extend for an unknown distance north-west of the head of the lake, and contain numerous veins, having an E.N.E. and W.S.W. direction, conformable with the strike of the beds, and some of them are auriferous. The vein-stuff is quartz containing copper pyrites; the gold is contained in the copper pyrites, or disseminated in very minute grains through the quartz. Several of these veins are being worked, and their peculiarities were noticed by the author.—"Note on the Relations of the supposed Carboniferous Plantants of Bear Island with the Palæozoic Flora of North America," by J. W. Dawson, LL.D., F.R.S. The author referred to Dr. Heer's paper on the carboniferous flora of Bear Island (see Q. J. G. S. vol. xxviii. p. 161), and stated that the plants cited by Dr. Heer as characteristic of his "Ursa Stage," are in part representatives of the American flora belonging to what the author has called the "Lower Carboniferous Coal-measures" (subcarboniferous of Dana). He considered that the presence of Devonian forms was due either to the mixture of fossils from two distinct but contiguous beds, or to the fact that in these high northern latitudes there was an actual intermixture of the two floras. He dissented altogether from Dr. Heer's identification of these plants with those of the Chemung group, or with those of the Middle Devonian of New Brunswick. Mr. Carruthers stated that the list of the eleven Lower carboniferous plants published in Principal Dawson's "Acadian Geology" did not contain a single species found in Bear Island; but, on the other hand, some species and several well-marked forms were common to the Bear Island deposits and the Devonians of North America, and he had no doubt that Prof. Heer had in his paper rightly correlated these floras. As to the age of these plant-bearing beds, found alike in Bear Island, Ireland, the Vosges Mountains, Canada, and Australia, Mr. Carruthers said that it was difficult to draw any lines which would separate the Palæozoic plants into clearly-marked and distinct floras; but if the Devonian is to be retained as a system, all these plant-bearing beds belonged rather to that system than to the carboniferous.—"Further Notes on Eocene Crustacea from Portsmouth." By Henry Woodward. In this paper, after referring to his former communication on Crustacea from the Lower Eocene deposits at Portsmouth (Q.J.G.S., vol. xxviii. p. 90), the author gave a full description of *Rhachiosoma bispinosa*, one of the new species described in it, the materials being furnished by several fresh specimens, which show the whole structure of the animal. The new points include the description of the limbs, the anterior border of the carapace, the lower surface of the body in both sexes, and the maxillipeds. The author also characterised, under the name of *Litoricola*, a new genus of shore-crabs allied to *Grapsus*, from the same deposits. Of this genus he described two new species, *L. glabra* and *L. dentata*.—"On a new Trilobite from the Cape of Good Hope." By Henry Woodward. The Trilobite described in this paper is from the Cock's Comb Mountains at the Cape of Good Hope, and was preserved in a nodule, the impression retained in which, when broken, furnished the most instructive details as to its structure. Each of the eleven thoracic segments was furnished with a long median dorsal spine, giving to the profile of the animal a crested appearance; on each side of this the axis of the segment bears two or three tubercles, and the ridge of the pleura four or five tubercles. The tail is terminated by a spine more than half an inch in length, and all the spines are annulated. For this Trilobite the author proposed the name of *Encrinurus crista-galli*, although with some doubt as to the genus, the head being only imperfectly preserved.

PARIS

Academy of Sciences, Dec. 2.—M. Faye, president, in the chair.—The first paper was by M. de Saint-Venant on the division of the force due to a vibratory movement into those due to simple and isochronous oscillations, &c., and of the work due to the same composite movements, at any two moments, between the constituent movements.—M. Claude Bernard read a note in answer to M. Bouillaud's paper on animal heat. He states that the latter author, in asserting that the arterial blood in the heart is warmer than the venous, has disregarded numberless experiments which prove the direct contrary to be the case. To this M. Bouillaud replied, defending the theory of the heat of the body actually being formed in the lungs by the combustion in them of carbon compounds in the blood, this being Lavoisier's original theory, which he defends.—A letter from Father Secchi on the meteors of Nov. 27 was then read; from 7.30 P.M. to 1 A.M. 13,892 meteors were observed.—MM. Is. Pierre and Ed. Puchot read a paper on certain observations on the laws deduced from the boiling points of the members of homologous series. The authors find that the rise in boiling point for each addition of $C H_2$ is not so regular as is supposed.—M. A. Caligny read a paper on the "Theory of the Sluice of L'Aubois," a paper

relating to canal works, and M. Thém Lestiboudois one on the structure of heterogenic vegetables. The section of the paper read related to heterogeneous monopetalæ. After this M. Dupuy de Lôme read a note on the preservation of the material of a "screw balloon."—A report on M. Felix Lucas's memoir on the general theorems of the equilibrium and movements of material systems was then read, and followed by a note by M. Marès on the utility of a permanent scientific institution in Algeria. M. H. Resal read a note on the relation between the pressure and the volume of steam which expands in producing work without the addition or subtraction of heat.—MM. E. Mathieu and D. Urbain read a paper on the part played by gases in the coagulation of milk and in producing muscular rigidity. The authors believe these effects to be due to oxidation.—Anatomical researches on limules, a note by M. Alph. Milne-Edwards, was next read, and followed by a description of a new method of treating intermittent fevers, by M. Déclat. A feature in this treatment is the administration of small doses of carbolic acid.—Communications on the *Phylloxera* from M. A. Laliman and M. A. Vidal were sent to the commission on *Phylloxera;* a note on the tertiary formations of Lormandieres, by M. Delage, was referred to a special committee; and notes on aerostation from MM. Billet, Braconnier, Deppe, and Chamard were sent to that commission.—A copy of the Janssen-Lockyer Medal was sent by the Minister of Public Instruction.—M. A. Laussedat then read a note on the prolongation of the French meridian into Spain and Algeria.—M. Mannheim described a model of a vernier to a vernier, and M. Gramme read a note on the application of his magneto-electric machines to electrotype and the production of light. He asserts that his machine produces greater effects than Wilde's well-known instrument, though driven at one-eighth of the speed.—M. Becquerel presented a note by M. E. Jannettaz, continuing his observations on the connection between cleavage planes, cohesion axes, and axes of thermic conduction in crystals.—M. Th. du Moncel presented the continuation of his paper on the currents produced in a telegraphic wire, one end of which rests insulated in the air.—M. A. Treve read a note on Magnetism, in which he describes some experiments on magnetic induction.—M. Balard presented a note on a new brominated ether, by M. P. Schützenberger. The formula of the new body is stated to be $(C_4\ H_{10}\ O\ Br_3)\ 2$. It is crystalline, very deliquescent, and heated to 70° to 80° disengages hydrobromic acid in large quantities and decomposes. M. Malhe described the manufacture of a neutral soap by exposing ordinary soap to carbonic anhydride.—MM. Rabuteau and Papillon read a note on the Therapeutic effects of Sodic Silicate. They believe that it is likely to be of great use in certain skin diseases. M. Picot's second note on the "Antifermentescible" properties of the same salt followed; he has used it with great success in cases of blenorrhagia.—M. A. Bechamp then read a note on certain of M. Pasteur's recent communications on ferments, a long contribution to the controversy, which has now nearly worn itself out, and followed it up with a joint communication of his own and M. Estor on M. Pasteur's paper of the 7th of October. M. P. Champion read a note on a substance extracted from a Chinese Champignon. The fungus is that known to the Chinese as Fouh-ling (*Pachyma pinctorum*). The author proposes to call the extract pachymose. It somewhat resembles starch, and its formula is $C_{20}\ H_{24}\ O_{28}$.—M. Claude Bernard presented a paper on the number of the Blood Corpuscles in Mammalia, Birds, and Fish, by M. Malassez. The author calculates that in the mammalia the number varies from 3,500,000 per cubic millimeter to 18,000,000; in man it is about 4,000,000. In birds the number is much less, from 1,600,000 to 4,000,000. In fish the osseous fishes have 700,000 to 2,000,000; the cartillaginous, 140,000 to 230,000. M. Larrey presented M. G. Le Bon's paper on some experimental researches on the Treatment of Asphyxia; which was followed by a note by M. L. Vaillant on the value of certain characters used in the Classification of Fish; and by a note on the larval form of the dragon-flies, by M. A. Villot.—A note by M. F. Pisani on a new vanadiferous-silicoaluminate of manganese from Salm Chateau, Belgium, was then read. The mineral contains 1·8 per cent. of vanadic acid, and in composition resembles masonite.—M. Daubree presented a paper on the superior Jurassic formations of the department of L'Herault, by M. Bleicher.—M. Stan. Meunier read a paper on the lithological analysis of the meteorite of the Sierra de Chaco, Chili; and on the mode of formation of logronite.—M. Le Verrier communicated a long list of observations of the meteoric shower of the 27th November from various observers.—A note on the same subject was received from M. Malinowski.—M. Champouillon communicated some experiments on the effects of borax and sodic silicate on malt; his results confirm those of M. Dumas. M. Sacc communicated a note on the colouring matter of the red carrot the colouring substance is insoluble in water, slightly so in alcohol, more so in ether. In the carrot it exists to the extent of not more than one part in 1,000.—M. Roenler described a method for reversing drawings for the engraver.—M. Prunières sent a note relative to the researches in lake Saint-Andéol (Lozère); he believes that the rest of the structures ascribed to man there found are those of beavers.—Mdlle. Chenu sent two notes on the "Functions of the Great Sympathetic" and on a method for the observation of the ganglionic nervous system, after the reception of which the session was adjourned.

BOOKS RECEIVED.

ENGLISH.—A Manual of Palæontology: H. A. Nicholson (Blackwood and Sons).—The Ocean, Section I. and II.: E. Reclus (Chapman and Hall).—Elements of Chemistry, Part I., 5th edition: W. A. Miller (Longmans).—Zoological Mythology, vols. I. and II.: A. de Gubernatis (Trübner).

DIARY

THURSDAY, DECEMBER 12.

ROYAL SOCIETY, at 8.30.—A Contribution to the Knowledge of Hæmoglobin: E. Ray Lankester—On the Structural Elements of Urinary Calcule: Dr. H. V. Carter.—Researches in Spectrum Analysis in connection with the Spectrum of the Sun. No. I.: J. N. Lockyer, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—On a Celtic Tumulus in Kent: C. Knight Watson, M.A.

LONDON MATHEMATICAL SOCIETY, at 8.—On Geodesic Lines, especially those of a Quadric Surface; and on the Mechanical Description of certain Quartic Curves by a modified Oval Chuck: Prof. Cayley.—Note on the breaking up of the Inharmonic-ratio Sextic: J. J. Walker.—On a Deduction from Standt's Property of Bernoulli's Numbers: J. W. L. Glaisher.

FRIDAY, DECEMBER 13.

ASTRONOMICAL SOCIETY, at 8.

SUNDAY, DECEMBER 15.

SUNDAY LECTURE SOCIETY, at 4.—On the Ear, and how we hear: John S. Bristowe, M.D.

TUESDAY, DECEMBER 17.

LONDON INSTITUTION, at 4.—On Elementary Physiology: Prof. Rutherford.

ANTHROPOLOGICAL INSTITUTE, at 8.—Origin of Serpent Worship: C. Staniland Wake.—The Garo Hill Tribes: Major Godwin-Austen.—The Kojahs of Southern India: Major Godwin-Austen.—Primosdial Inhabitants of Brazil: Capt. Burton and M. H. Gerber.

WEDNESDAY, DECEMBER 18.

SOCIETY OF ARTS, at 8.—On Russia, her Industries, Commerce, and Means of Communication: Prof. Leone Levi.

GEOLOGICAL SOCIETY at 8.—Further Notes on the Punfield Section: C. J. A. Meyer.—On the Origin of Clay-Ironstone: J. Lucas.—On the Coprolites of the Upper Greensand Formation, and on Flints: W. Johnson Sollas, St. John's Coll. Camb.

ROYAL SOCIETY OF LITERATURE, at 8.30.

THURSDAY, DECEMBER 19.

ROYAL SOCIETY, at 8.30.

LINNEAN SOCIETY, at 8.—On the General Principles of Plant-construction: Dr. M. T. Masters, F.R.S.

CHEMICAL SOCIETY, at 8.

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