tions to the latter, he said the problem was whether or not there were two great series of metamorphic rocks unconformable to each other, the older referable to the Archæan age, the newer to the Lower Silurian. Some reference was made to the great faults and foldings of these beds, which were stated to range generally in N.N.E. and S.S.W. lines. It was considered that the granites might belong to at least two periods—the intrusive being distinct both in age and structure from the metamorphic granite and gneiss. Other points noticed were the occurrence of numerous basaltic dykes, probably of Tertiary age, traversing the gneissose rocks; and marginal representatives of the Lower Carboniferous period.

On the Classification of the Carboniferous Limestone Series; Northumbrian Type, by Hugh Miller, F.R.S.E., F.G.S., of H.M. Geological Survey.—The object of this paper was to show that the classification proposed twenty years back by G. Tate of Alnwick is still sufficient, not only for North Northumberland, where Tate established it, but also for the south of the county. Prof. Lebour has proposed another classification on the assumption that Tate's divisions either do not exist in Nature, or do not persist throughout the county. Tate's classification, amplified in some not very important details, and adapted to the work of the Geological Survey, is as follows:—

		Feet
Upper Limestone Series	*Felltop or Upper Calcareous Division:—From the Millstone Grit to the zone of the Great Limestone.* Sandstones and shales; one or more beds of marine limestone, including the Felltop Limestone; some coals	350-1200
	Calcareous Division:—From the great Limestone to the bottom of the Dun or Redesdale Limestone. Many beds of good marine limestone; sandstones and shales; coals	1300–2500
Lower Limestone Series	*Carbonaceous Division (Scremerston Beds of North Northumberland:—From the Dun or Redesdale Limestone to Tate's "Tuedian Grits."* Strata prevalently carbonaceous; limestones chiefly thin, many of them containing vegetable matter; coals	800-2500
	Tuedian Division:—Upper Tuedian or Fell Sandstone Group, the "Tuedian Grits" of Tate:—From the Carbonaceous Group to the Cement-Limestones. Great belt of massive grits (Tweedmouth, Chillingham, the Simonside, and Harbottle Hills, the Peel, and Bewcastle Fells). Shales greenish and reddish as well as carbonaceous gray; coals rare, thin, or absent ...	500-1600
	Lower Tuedian or Cement-Limestone Group:—From the base of the Grits downwards. Cement-stone bands passing into limestones (Rothbury, Bewcastle); coals very rare; generally some coloration of the shales and sandstones	500–1500
	Basement Conglomerates (Upper Old Red Sandstone); local	—

Notes on the Crystalline Schists of Ireland, by Ch. Callaway, D.Sc., M.A., F.G.S.—The author gives a summary of results obtained by a preliminary survey of the principal areas of Irish metamorphic rocks in Donegal, Connemara, and the south-eastern corner of the county of Wexford. In each of these areas the following facts were observed:—(*a*) A series of hypometamorphic rocks, consisting typically of fine-grained schists, altered grits, and quartzites. A clastic structure is more or less distinct in the three areas, but is least evident in Connemara. (*b*) A group of highly crystalline schists, displaying no trace of an original sedimentary origin, dipping as if it passed below the hypometamorphic rocks. At Wexford there are true gneisses. In Connemara the rocks are less feldspathic, the chief types being quartzose gneiss, quartz-schist, mica-schist, hornblende-schist, quartzite, and crystalline limestone. This description will also apply to Donegal. (*c*) Granite, underlying (*b*), and in Connemara and Donegal clearly intrusive. The author urges that this analogy is not due to the metamorphic action of the granite; for—(1) The mineral characters apparent in the schists adjacent to the granite are uniformly distributed through the lower series from bottom to top. (2) The evidence collected is hostile to the view that this lower series ever graduates into the upper. It is concluded that the balance of proof is in favour of the Archæan age of the bulk of the Irish schists. (1) In the Wexford district the schists are thrown against Cambrian and Ordovician rocks by faults, and do not pass into them in the localities alleged by the Irish Survey. (2) In Connemara conglomerates of Llandovery age contain large rounded fragments, not only of the older schistose series, but also of its intrusive igneous rocks. (3) In the Ulster region the metamorphic area is separated from the Ordovician rocks of Pomeroy by a ridge of granite and diorite three miles in breadth. The lithological analogies between the Irish schists and the Archæan rocks of Anglesey and other British metamorphic districts are also of weight in the argument.

SOCIETIES AND ACADEMIES

EDINBURGH

Royal Society, July 19.—The sense of taste, by John B. Haycraft. Sensation or feeling is a result of the operations of the external world upon our sentient bodies. A vibration of light, a sonorous wave, a molecule of sugar or of musk stimulates the appropriate nerve through the mediation of a little sensitive cellule in the eye, the ear, the tongue, or the nose. A motion called a *nerve motion* is then set up, passes to the brain, and if this organ is in a state of activity we are conscious of a feeling or sensation. In the case of sound and light the character of the vibration determines the quality of the sensation produced. Thus, a certain complex vibration of light produces a sensation we call crimson, a certain complex vibration of sound we recognise as coming from a violin-string. Motion is thus transmitted into a nerve motion or impulse, which gives rise to a sensation. Of the thousand qualities of sensation all have a counterpart in the thousand variations of motion outside the body. The physiologist knows little more about the production of the sense of taste than those facts which are the intellectual property of every one. The object of the author of the paper of which this is a short abstract is to show that taste in its method of production is precisely analogous to sight and hearing. The truth of this is indicated by the striking similarity in structure between the end-organs of all the special senses, which are all developed from primitive ectodermic cells, of much simpler form. Spectroscopic investigation has demonstrated, too, that the sapid and odorous molecules vibrate constantly and in a manner characteristic of each substance. We have, then, in the case of taste (and it is hoped subsequently to demonstrate this in the case of smell as well), vibrating matter and a sensitive end-organ, conditions analogous with those present in the other senses. If it can be shown that substances vibrating in the same manner produce the same taste, the analogy will be complete. It has been found by Newlands and others that if the elements be arranged in a series, starting with that metal which has the lowest, and passing up to that which has the highest, atomic weight, a periodic recurrence of chemical and physical properties is observed. Thus lithium, the second in the series, is similar to sodium, the ninth, and potassium, the sixteenth, and so on. This is called the periodic law. The author finds that there is also a periodicity as regards taste production. Thus the chlorides or sulphates of a series of similar elements—called a group of elements by Mendelejeff—have similar tastes. It is curious, however, that the taste changes slightly but uniformly as we pass to the higher members of a group. Thus the chlorides of lithium and sodium are salt, but as you pass to the higher members of the group the taste becomes more saline and very slightly bitter. Now Prof. Carnelley has recently discovered that compounds containing elements of the same group have similar colours, the colour changing, however, uniformly—passing to the red end of the spectrum—as we reach the higher members of a group. Colour is periodic. But this indicates that the elements of the same group are vibrating in a similar way. If the lower member be yellow from absorption of the blue, the next one will have vibrations of nearly the same pitch, being in reality at a somewhat slower rate of vibration, and absorbing rays nearer the red end. Here, then, is the analogy sought for. A group of salts of similar chemical properties have their molecules in a similar vibrating condition, giving rise to similar colours and similar tastes. A study of the carbon compounds yields as conclusive evidence. The alcohol bodies, such as mannite, grape-sugar, glycerine, glycol, are sweet. They possess a certain common molecular structure and a compound radical, $CH_2.OH$. Associated with this radical is the taste called sweet, just as are associated with it many chemical and physical properties. Common alcohol is tasteless, but it is monatomic, all the polyatomic alcohols having a sweet taste. The organic acids, too, have a radical, CO.OH, with which seems to be associated their acid properties and the power of producing a special taste. Now it is certain that compound radicals, like elementary substances, vibrate in a definite way, however they are combined. A coloured acid like chromic and picric acid forms a class of coloured salts. Ammonia viewed in quantity shows characteristic absorption-bands; replace an atom of hydrogen by ethyl or methyl, and the same bands are to be observed, shifted, however, slightly towards the red end of the spectrum. We see, then, in the carbon compound the radical vibrates, modifies light passing through it in a definite way, and affects the sensorium by causing the production of a definite sensation of colour. So too it can produce a definite taste sensation. I do not hazard an opinion as to how the molecule stimulates the end-organs in the tongue. Too little is known about the stimulation of the retina by light. Whether or not in both cases it is mechanical, one cannot say. As to its being chemical action, it may well be asked, What is this? Chemical action itself may perhaps be most satisfactorily interpreted by the use of a mechanical hypothesis. Much has yet to be discovered as to the exact relationship between vibration and taste sensation. That this relationship exists, is all the author wishes to prove. When spectroscopic investigation of the invisible spectrum is more advanced, what Helmholtz has done for sound may also be done for taste, and we may know the exact vibrational counterpart of a taste quality as we know it already of the sound of a violin-string.

PARIS

Academy of Sciences, September 13.—M. Émile Blanchard in the chair.—Experiments on the electrical conductibility of gases and vapours, by M. Jean Luvini. A series of experiments are described, which have led the author to the general conclusion that, under all pressures and at all temperatures, gases and vapours are perfect insulators, and that they cannot be electrified by friction either with themselves or with solid or liquid bodies. Crucial tests were applied to air saturated with the vapour of water at temperatures ranging from 16° to 100° C.; to hydrogen and carbonic acid not dried, but just as they left the bath generating them; to the vapour of mercury at 100° C.; the vapours of sal ammoniac; air heated by live embers or the flame of a candle; the fumes of sugar, camomile, incense, &c., none of which vapours gave the least indication of conductibility. Hence to suppose, as is generally done, that very rarefied gases, or gases at very high temperatures, are conductors, is a mistake due to confusion between resistance to disruptive and conductive discharges. Thus Masson has shown that at like potential the distance of the disruptive discharge in the air is twelve or thirteen times greater than in water, which simply means that the resistance of water to the disruptive discharge is greater than that of air, not that air is a better conductor than water. Henceforth physicists will have to reject all theories regarding the electricity of machines, the air, or clouds, in which moist air is assumed to be a conductor, or in which gases and vapours are supposed capable of being electrified by friction.—Quantitative analysis of the dry extract of wines, by M. E. Bouilhon. In order to shorten the ordinary tedious process, some chemists separate the liquids by means of porous bodies increasing the surface of evaporation. But this method leads to fallacious results, numerous experiments showing that all increase of the surface lowers the weight of the residuum to a very considerable extent, in consequence of the evaporation of a portion of the glycerine. Thus a litre of claret yielded 22·4, 22·0, and 21·2 grammes of sediment according to the various forms and sizes of the vessels employed in the process.—On *Fecampia erythrocephala*, a new species of Rhabdocœle, parasitic and nidulating, by M. A. Giard. This species, which is very common on the coasts of Fécamp and Yport, is shown to differ considerably from Graffilla and the different genera of Rhabdocœle hitherto described. It appears greatly to resemble a parasite discovered by Lang in the foot of *Tethys fimbriata*, and a more complete study of this Mediterranean type will no doubt show that, like the parasite here described, it also secretes a cocoon.—Researches on the circulatory apparatus of the Ophiures, by M. R. Kœhler. The circulatory system of these organisms, as here described, appears to be very analogous to that of the Echinidæ, as already revealed by previous investigations of the author and M. Prouho. Both groups present the same structure of the madreporic gland, the same relations of this gland, on the one hand with the periphery, on the other with a peribuccal ring; two peribuccal rings throwing off two branches in the same directions; lastly, the absence of aboral circle.—On the heart, digestive tube, and reproductive apparatus of *Amaræcium torquatum* (a Compound Ascidian), by M. Charles Maurice. In this paper the author determines the true physiological functions of some of the organs already observed by Seeliger, Von Drasche, and Della Valle in other species of Ascidians.—On the annual movement of the barometer in European Russia, by General Alexis de Tillo. While the yearly oscillations of the barometer in Siberia may be figured by a curve of somewhat simple type, those of European Russia are shown to be of a much more complicated character. From the numerous records published by the St. Petersburg Central Physical Observatory, the author has deduced the mean monthly readings for eighty meteorological stations in this region, and these data have enabled him to determine the mean type of the annual barometrical curve for the centre of European Russia. As it advances eastward in the direction of Siberia and Central Asia, this curve loses its secondary maxima and minima, while on the other hand its amplitude increases gradually.

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