two spectra are formed, one from blood on the stage of the microscope, and the other from the same on the stage of the eye-piece.

The dark band of the chlorophyll spectrum is slightly variable in width—and the action of acids and alkalies sometimes causes a slight displacement, the former raising (moving toward the blue end) and the latter depressing. The endochrome of a diatom after treatment with acid is green, and the acid, in this case, produces scarcely any displacement of the band, which may be observed even in the dark reddish mass of the dead Diatomaceæ, almost identical in colour with the ferrous carbonate so often found in bogs where the larger diatoms are abundant; and what is more remarkable is, that the carbonate gives no absorption bands at all. As a general rule, alcoholic solutions of chlorophyll and diatomin have the band slightly depressed, reading 1 to 1½ on the interference scale.—[Amer. Jour. Sci. and Arts.]

CHEMISTRY

Thallium Salts.—I.

MM. LAMY AND DES CLOISEAUX have resumed the study of the principal thallium salts, with the view of ascertaining their chemical composition, optical properties, and crystalline form (Annales de Chimie et de Physique, xvii. 310). The method of obtaining crystals was that which M. Deville has for a considerable time been in the habit of employing in his laboratory. A given substance is placed in contact with water, or some other solvent, either in a closed or lightly covered vessel, and exposed to the usual conditions of temperature of an inhabited apartment; if these do not suffice, the liquid is heated every day for an hour to a certain extent. In course of time, even the most microscopic crystals, if submitted to this process, become large, well-formed, and transparent.

The thallium in these salts was determined as iodide; a compound which from its sparing solubility (especially in water containing a little potassic iodide), as well as on account of its great specific gravity and crystalline character, is very well adapted to the purpose. The density of thallous *sulphate*, Tl_2SO_4, is 6·603,* and its form a right rhomboidal prism, geometrically and optically isomorphous with ammonic sulphate. The crystals often appear unsymmetrical, on account of the unequal development of the different faces. The optic axes are wide apart; and the dispersion of the axes, as observed in oil, is feeble, with $\rho < \nu$. To the already known† thallium *alums* may be added a mixed series, having the general formula:

$$(Al_2O_3 . Fe_2O_3)3SO_3 + (K_2O . Tl_2O)SO_3 + 24Aq.$$

Special attention is directed to one of these, which was obtained accidentally in the course of a lixiviation, and had the formula:

$$[(Al_2O_3)^{\frac{2}{3}}(Fe_2O_3)^{\frac{1}{3}}]3SO_3 + [(K_2O)^{\frac{3}{4}}(Tl_2O)^{\frac{1}{4}}]SO_3 + 24Aq.$$

Its colour is slightly yellow, and in solubility it much resembles potassic alum. After several solutions and recrystallisations, the whole of the iron is removed, and the following alum appears:

$$Al_2O_3 . 3SO_3 + [(K_2O)^{\frac{3}{4}}(TlO)^{\frac{1}{4}}]SO_3 + 24Aq.$$

Zinco-thallous sulphate—

$$Tl_2SO_4 + ZnSO_4 + 6H_2O,$$

which had already been described by Willm and Werther, belongs to the oblique rhomboidal prismatic system, and is geometrically isomorphous with ammonio-ferrous sulphate, potassic magnesio-sulphate &c. (as, indeed, Werther has shown); but it is optically different from these salts, both in orientation and in the sign of its acute bisectrix (negative).

Plane angle of the base	107° 5′ 14″
Plane angle of the lateral faces	99° 31′ 24″
Obliquity of the primitive prisms . .	106° 10′ 00″

The optic axes lie in the plane of symmetry. There is a strong proper dispersion with $\rho < \nu$. The *inclined* dispersion is weak, and only brought out by a difference in the brightness of the colours lying at the edges of the hyperbolæ of the two systems of rings. Thallous *nitrate*, $TlNO_3$, has the specific gravity 5·550, and occurs in right rhomboidal prisms of 125° 52′ (the corresponding angle for nitre is 118° 50′). The plane of the optic axes is perpendicular to the corresponding plane in potassic nitrate. The acute bisectrix is negative, and the dispersion of the axes considerable, with $\rho < \nu$. This salt had been already examined optically by Miller. In order to prepare thallous *carbonate*, (Tl_2CO_3), a saturated solution of thallous oxide in alcohol was exposed to air, in contact with a lamina of thallium. At the end of six months, very large crystals were obtained. These have an adamantine lustre, and a specific gravity 7·164; they belong to the clino-rhombic system, thus agreeing neither with plumbic, potassic, nor ammonic carbonate. Macles by hemitropy round one particular axis, are frequently observed. The plane of the optic axes is normal to the plane of symmetry, and almost exactly perpendicular to the base. The acute bisectrix is negative, and normal to the horizontal diagonal of the base; the double refraction energetic. The dispersion of the optic axes is well marked, with $\rho < \nu$; while the *horizontal* dispersion is, on the contrary, inappreciable. An attempt to prepare other thallous carbonates did not succeed.

Di-thallous *phosphate*—

$$2[Tl_2HPO_4] . H_2O,$$

is a very soluble salt, anhydrous at 200°, and crystallises in the rhombic system. Lustre vitreous. The dispersion of the optic axes is strong, with $\rho > \nu$. *Mono*-thallous *phosphate*—

$$TlH_2PO_4,$$

is very soluble in water, and readily crystallises in long voluminous needles which were submitted to the growing process already described. Density 4·723. The crystals may be referred to a clino-rhombic prism of 34° 59′, having a base only slightly sloping towards the lateral faces. Macles by hemitropy are common, giving rise to a re-entering angle of 176° 32′. The plane of the optic axes is parallel to the horizontal diagonal of the base. Acute bisectrix negative; horizontal dispersion indistinct; proper axial dispersion considerable. The *pyrophosphate*— $Tl_4P_2O_7$, crystallises in magnificent transparent prisms, soluble in water with partial decomposition, softened by a heat of 120°, and having the density 6·786. Its form is an oblique rhomboidal prism. The crystals are fragile, and have a somewhat adamantine lustre. The plane of the optic axes is normal to that of symmetry, and almost parallel to the base. While the horizontal dispersion is but slight, the proper dispersion of the axes is the greatest hitherto observed, as shown by the following means of measurements taken in oil and air, determining the apparent separation of the axes in air at 24°:

$2E = 125° 48′$ (red rays); 112° 30′ (yellow);
$2E = 89° 47′$ (green rays); 52° 34′ (blue).

The *hydrous pyrophosphate*—

$$Tl_4P_2O_7 + 2H_2O,$$

separates from the mother-liquid of its predecessor. It is soluble in water with but little decomposition; but it is less stable at a high temperature than the anhydrous salt, which, on the other hand, it exceeds in the intensity of its vitreous lustre, its hardness and cohesion. The plane of the optic axes is normal to the plane of symmetry: the acute bisectrix negative and perpendicular to the horizontal diagonal of the base. Horizontal dispersion feeble; proper dispersion of the axes considerable, with $\rho < \nu$. The *ammoniacal thallous phosphate*—

$$3NH_3 . H_3PO_4 + 2NH_3 . H_2TlPO_4$$

is obtained by adding ammonia to the common phosphate, filtering to remove tri-thallous phosphate, and evaporating the mother-liquid. The crystals are very soluble in water, and completely isomorphous with ammonic phosphate. Their figure is that of a right prism with square base, elongated in the direction of the vertical axis, and terminated by an octohedron of 119° 50′. The double refraction is on a negative axis.

E. J. M.

* The temperature in this and following determinations is not given in the memoir.

PHYSICS

Pfaundler on the Regelation of Ice

THE fact observed by Faraday that two pieces of ice freeze together when brought into contact has met with various explanations. Helmholtz, for example, assumes that pressure is always at work in regelation; hence depression of the fusion point of the ice, and a cold sufficient to freeze a small portion of water in another part of the mass. Tyndall, on the other hand, admits the hypothesis of pressure only where it is actually observable; but, in other cases, explains the phenomena by a difference between the fusion-point inside and at the surface of the ice. Schultz has actually verified Tyndall's theory with water from which the air had been expelled.

Pfaundler has recently reconsidered this subject, and states the question as follows :—"Can a piece of ice, surrounded by water at 0°, preserve its shape if the water undergo no disturbance?" So far as we know at present, both weight and figure remain unchanged. Either, then, a part of the ice must melt, or a part of the water freeze, or both of these phenomena happen together. Such alterations involve certain mutations of the amount of heat contained in the surrounding water, or, at least, of the equilibrium of temperature in different parts of the liquid. Now, Clausius's researches into the constitution of liquids show that, in the case of individual molecules, such an equilibrium does not exist. Moreover, the conditions of molecular movement at the free surface of the ice are evidently different from those that are within. Hence, the piece of ice must grow, in certain places and in certain directions, at the expense of other of its parts; the increment at one spot corresponding to the decrement at a different one. Two pieces of ice in contact, or even in close proximity, are therefore likely to freeze together.

By freezing water in a flask under a pressure of a decimetre of mercury, solidification was invariably promoted; and it not unfrequently took place in a direction which was definitely related to what may be called a great circle of the flask.

Pressure, however, is not the only source of regelation. According to the author's theory, the phenomenon may result from any *molecular* disturbance.

PHYSIOLOGY

Coagulation of Blood

PROF. MANTEGAZZA cuts the Gordian knot of the cause of the coagulation of the blood, by attributing it to an action of the white corpuscles of the blood. Admitting Schmidt's theory of fibrin being the product of fibrinoplastin and fibrinogen, he puts forward the idea that normal plasma of the blood contains fibrinogen only, but that the white corpuscles have the power, when irritated, of emitting, or we might almost say secreting, fibrinoplastin, and thus of causing coagulation. The shedding of blood, any contact with foreign substances, are causes of irritation to the white blood corpuscles, and hence these things become in turn causes of coagulation. In support of this theory he insists on the complete coincidence of the power of coagulation with the presence of white blood (or lymph) corpuscles; and on the fibrinoplastic properties of tissues, such as cornea, &c., which abound in cells similar at least in nature to white blood corpuscles.—(Ann. di Chim., July 1869.)

THE *Journal of Anatomy and Physiology*, No. 5, November 1869, contains many valuable papers, *e. g.* on the Muscles of the Limbs of the Anteater, &c., by Professor Humphry; on the Movements of the Chest, by Dr. Arthur Ransome; on the Chemical Composition of the Nuclei of Blood Corpuscles, by Dr. Brunton; an abstract of Mr. E. Ray Lankester's Report on the Spectroscopic Examination of Animal Substances; and a long paper by Dr. T. A. Carter, on the Distal Communication of the Blood-vessels with the Lymphatics. The abstracts of Anatomy and Physiology are still continued with the completeness, accuracy, and critical intelligence which render them the best things of the kind to be found anywhere. Dr. Moore, the indefatigable translator from Dutch and other unusual tongues, supplies a translation of a very interesting paper by Engelmann, on the Periodical Development of Gas in the Protoplasm of Living Arcellæ. We may congratulate ourselves on the fact that the journal is able to make its way, in spite of the difficulties with which in this country Anatomy and Physiology have to contend.

SOCIETIES AND ACADEMIES

LONDON

Royal Geographical Society, November 22.—Sir Roderick Murchison in the chair. A paper was read detailing the results of an exploration of the new course of the Hoang-Ho, or Yellow River, made in 1868, by Mr. Elias, a young merchant of Shanghai, illustrated by a map, the positions in which had been carefully laid down from observations taken by that gentleman. The Chinese records, which are very copious in relation to this turbulent river, mention nine changes of its course, dating from 602 B.C. to the last in 1853, during which its outlet has shifted from 34° to 40° north latitude, the present being the former mouth of the river Tsa-Tsing, in the Gulf of Pecheli. The gradual elevation of the bed of the river caused the waters to press against the upper portion of the embankments, and as neither the dykes were raised, nor the bed deepened, the waters effected a breach in 1851, which was enlarged in the following year, till in 1853 the whole stream flowed through the mile-wide breach, in a north and east direction, leaving the old course dry. From this breach at Lung-Menkau, the river flowed in an ancient bed for 52 miles, but from that point a tract 96 miles long was inundated to a width of 15 miles. Ruined houses, broken bridges in the midst of the waters, and the remains of the banks of two canals forming the northern and southern channels, and here and there vast stretches of mud—were all that told of a once fertile and populous district. The deserted houses were in many cases silted up to the eaves by the alluvial deposit. In the dry season fifteen inches of water were scarcely found in some places. At Yushan the waters converged into the bed of the former river, Tsa-Tsing, now usurped by the Yellow River. The Grand Canal crossed this flooded district, but its banks have been carried away and its communication to the north destroyed. Proceeding down, a broken bridge of seventy arches obstructed the stream it could not span. For 150 miles a fertile and garden-like country was passed through, to which succeeded a barren treeless waste, except for the belt adjoining the river, which was fertile and cultivated; the ground, however, even with the growing crops, and in one place the town wall, was undermined and carried away piecemeal by the encroaching river. A barren, marshy tract of reeds, tenanted by wildfowl, extended for about twenty miles from the sea. This change of course, has, it is said, cost the Chinese Empire fifty to sixty millions of its population, the country lying on the old course having been ruined by the drying up of the river, and that in the new by the floods. The new course is unfit for navigation. Vessels drawing six feet of water might cross the bar, and proceed with difficulty to Yushan, but none beyond.—Captain Sherard Osborn remarked that in 1818 the Chinese Censors had called the Imperial attention to the impossibility of effectually controlling the Yellow River; although the expense of the maintenance of the dykes had been quintupled. The maladministration which had resulted in this calamitous change could not, therefore, be chargeable to British interference with China. British engineers, if employed, would soon restrain the Hoang-Ho within due bounds, and utilise its waters for navigation and irrigation. The Chinese water-systems were beginning to be better known, and he hoped that the Upper Yangtse would soon be opened to our steamers, for every forward footstep of Englishmen would, he believed, be a blessing to China.—Mr. Wylie, the first Englishman who saw the results of the diversion of the river from its course, gave an account of his crossing the river bed, then become a sandy highroad covered with passengers, and some particulars of a journey made by him to the sources of the Han River, in which he identified the pass described by Marco Polo as the White Horse Pass.

Royal Asiatic Society, November 15.—This was the first meeting of the Society after the recess. Mr. W. E. Frere occupied the chair. A paper was read containing an Account of the Bheel Tribes of the Vindhya and Satpura Ranges, by Lieut. J. Waterhouse. The writer starts from a popular tradition among those tribes, according to which the originator of the Bheel race is said to have been a vicious and deformed son of Mahadeva, who, on account of his having killed his father's favourite bull, was sent off to the jungle and uninhabited wastes, and told to cultivate where he chose. From this tradition, combined with the well-known legend of the Mahabharata and Shrî Bhagavata, by which the Nishadas are said to have descended from the Rajput king Vena, Mr. Waterhouse concludes that the Bheels had originally been settled in Judhpur and Marvar, but being driven thence by Rajputs, they emigrated southwards and established themselves in the mountains of Malwa and Candeish, in the Vindhya and Satpura ranges, and on the rugged banks of the Nerbudda and Tapti, where, protected by the natural conditions of the country, they had since dwelt, subsisting partly on their own industry, but mainly by inroads into the surrounding plains. Moreover, it was stated in the history of the princes of Judhpur and Oodeypur, that the Rajputs originally conquered their country from the Bheels. These are then divided by the writer into three classes—the Village, the Cultivating, and the Mountain Bheels. The first are said to consist of a few only, who, being scattered over the villages on the plains, were generally considered as honest and trustworthy, and