would produce complete decolorisation. If, on the other hand, the same solution be added in the same quantities to wine which has been artificially coloured red, the deception will soon become apparent by the speedy decolorisation of the liquid, or by the communication of some different colour to the liquid and to the precipitate. The following table exhibits the various colours assumed by the liquid and precipitate produced under these circumstances in wine coloured by different substances—

Substances added.	*Colour of Liquid.*	*Colour of Precipitate.*
Pernambuco wood	Light orange red	Reddish yellow
Campeachy wood	Golden yellow	Orange yellow
Archil	Very light red	Reddish yellow
Laccamuffa	Very light green	Greenish-grey
Prepared Cochineal	Nearly colourless	Grey
Fitolacca	Nearly colourless	Yellowish
Myrtle	Nearly colourless	Dingy-greenish
Violets	Very light rose	Yellowish
Colouring matter of normal wine	Persistent wine-red.	Blood-red

Dye-woods resist decolorisation more strongly than vegetable juices; and Brazil wood, when treated with the above-mentioned reagent, aided by heat, acquires a crimson-red colour, due to the formation of brazilin.—[Ann. di Chim. app. alla Med., September, 1869, p. 142.]

PHYSICS

Professor Magnus on Heat Spectra.

PROFESSOR MAGNUS has recently contributed to the Berlin Academy a memoir on the radiation and absorption of heat at low temperatures. The results, which are of the highest importance, are essentially as follows:—

1. Different bodies, heated to 150° C., radiate different kinds of heat.

2. Some substances emit only one kind, some many kinds, of heat.

3. Of the first class, perfectly pure rock-salt is an instance. Just as its incandescent vapour, or that of one of its constituents (sodium), is solitary in tint, so the substance itself, even at 150°, emits heat of but a single ray. It is monothermic, just as its vapour is monochromatic.

4. Rock-salt absorbs heat radiated from rock-salt in larger quantity, and more powerfully, than that derived from sylvine and other kinds. It does not, therefore, as maintained by Melloni and Knoblauch, transmit heat from all sources with uniform facility.

5. The amount of absorption effected by rock-salt increases with the thickness of the absorbing plate.

6. The high diathermancy of rock-salt, does not depend on its small absorptive power for the different kinds of heat, but on the fact that it only radiates (and, consequently, only absorbs) heat of one kind; while almost all other bodies at the temperature of 150° emit heat which contains only a small fraction or none of those rays which are given out by rock-salt.

7. Sylvine (potassium chloride) behaves like rock-salt, but is not monothermic to an equal extent. This circumstance is also obviously in analogy with the incandescent vapour of the salt, or of potassium, which is known to furnish an almost continuous spectrum.

8. Heat purely derived from rock-salt is almost completely absorbed by fluor-spar: It might thence have been expected that heat radiated from fluor-spar would also be energetically absorbed by rock-salt; yet 70 per cent. of it traverse a plate of rock-salt 20 mm. in thickness. If we remember that the total heat emitted by fluor-spar is more than thrice as large as that of rock-salt, this phenomenon is readily explicable; nevertheless, it is probably dependent upon some other property of fluor-spar.

9. If a spectrum could be projected of the heat radiated at 150°, and rock-salt were the radiating substance, such a spectrum would contain only *one* band. If sylvine were employed, the spectrum would be more expanded, but still would only include a small portion of the spectrum which would be given by the heat radiated from lamp-black.

In a subsequent communication, Herr Magnus treats of the reflection of heat radiated at the surfaces of fluor-spar and other bodies.

Having succeeded in obtaining the heat from different substances at 150° free from the rays of flames and other thermogenic bodies, and afforded proof that there are some substances which emit waves of one or but few lengths, while others present them in more frequent variety, it next appeared interesting to solve the problem how bodies behave with reference to reflective power; whether, in bodies which act similarly upon light, differences parallel to those which are observed in respect of the absorption and transmission of heat do not also occur in its reflection.

Differences in reflective power are unmistakably apparent only when rays are reflected which have a uniform, or but slightly varying, length. Such rays have already been derived either from a section of the spectrum furnished by a rock-salt prism, or by transmitting the rays from a source of heat of many wave-lengths through substances which absorb a number of them. There are, however, but very few bodies that transmit rays of only one or a few wave-lengths; moreover, such rays, obtained by either method, have a very low intensity.

In spite of this difficulty, MM. de la Provostaye and Desains showed, as early as 1849, that different quantities of the heat from a Locatelli's lamp were reflected from speculum metal, silver and platinum, according as it had been conducted through glass or rock-salt; and, for reflecting surfaces of all kinds, less in the case of glass than in that of rock-salt.

Soon afterwards, by an extended series of experiments, and employing the prismatically dispersed heat of a lamp, it was proved by the same physicists that heat from the different portions of the spectrum is differently reflected. But, doubtless in consequence of the low intensity of the incident heat, their researches had reference solely to reflection by means of metallic surfaces. Now, if in rock-salt we possess a substance that emits waves of only one or but few lengths, and are acquainted with other bodies which, at 150°, also radiate but a few kinds, researches can be instituted on reflection at non-metallic surfaces. It has thus appeared that the different kinds of heat or wave-lengths are reflected from such surfaces in very different proportions. One of the most striking examples may here be adduced: it refers to the reflective power of fluor-spar.

Of the heat radiated by a great variety of substances, unequal (though but slightly differing) amounts were reflected at an angle of 45°; being in the case of—

Silver	between	83	and	90	per cent.
Glass	,,	6	,,	14	,,
Rock-salt	,,	5	,,	12	,,
Fluor-spar	,,	6	,,	10	,,

But of the heat from rock-salt, fluor-spar reflected 28 to 30 per cent., whereas silver, glass, and rock-salt returned no more of this heat than in the preceding cases.

Here, too, it was evident, as in the experiments on thermic transmission, that sylvine emits, besides a large quantity of the rock-salt kind, species of heat of another nature. Fluor-spar reflects 15 to 17 per cent. of the heat from sylvine; less, consequently, than that from rock-salt, and more than that from the other radiating bodies.

Granted an eye that could distinguish different wave-lengths of heat in the same manner as wave-lengths of light, and when the waves from rock-salt are incident upon different bodies, fluor-spar will appear to it brighter than any. If the rays are derived from sylvine, fluor-spar would seem still brighter than all the above bodies, but not so bright as when submitted to the rock-salt rays.

Melloni has shown that different substances transmit heat in very unequal proportions, and that the source of heat has a marked influence on the facility of transmission. Still, the sources of heat were only distinguished by degree; it was merely recognised that an increased temperature corresponds to increased variability of wave length. It now appears that at one and the same temperature, and *that*—viz., 150°—far below incandescence, different substances emit very different kinds of heat, and that, within such a range, an extraordinarily large number of different heat-rays or wave-lengths continually intermingle. This manifold intermixture is particularly furthered by the selective reflection taking place at the different surfaces.

It follows from what has been said that an eye capable of discerning the different wave-lengths of heat, as it can now discriminate the colours of light, would perceive, with very little warmth to itself, every possible variety of tint in surrounding objects.

PHYSIOLOGY

Pettenkofer on Cholera

NEARLY the whole of the second part of the Zeitschrift für Biologie, bd. v. (300 pages), is taken up by a long memoir by Prof. Von Pettenkofer on "Soil and Sock-water in their

Relations to Cholera and Typhus" (Boden und Grundwasser in ihren Beziehungen zu Cholera und Typhus) in which he developes at length his views. To many these are probably now well known, but still, it may be perhaps as well to state that they are somewhat as follows.

The phenomena of Cholera result from the introduction into the animal system of a cholera poison, which is possibly an organic being, and which we may call *z*. Now, *z* is non-reproductive; does not of itself multiply or spread. But there is another distinct thing, the cholera germ (originating in India), which we may call *x*. *x* of itself will not produce cholera symptoms. It may remain, and probably may multiply in the human body, and be carried in or on the body from place to place without *of itself* producing cholera. Cholera symptoms can only be brought about by *z*, and *x* can only give rise to cholera, indirectly, by generating *z*. But *x*, in order that it may generate *z*, must come in contact with and act upon another substance, which we may call *y*. That is, *x* cannot germinate into *z* unless it meets with the substratum *y*; or we may use the idea, thrown out we believe by Dr. Farr, and imagine *x* and *y* to be the male and female parents of the offspring *z*, which is either sterile, or can only reproduce *x*.

Thus, then, *x* originating at certain times in India, and meeting with *y* at once gives rise to *z*, and an outbreak of cholera is the result. The quantity of *z* is probably more than sufficient to account for all the cases that occur; the surplus may even perhaps be carried about, and so spread the epidemic; but there being no reproduction of *z*, the stock would soon be exhausted. With *z*, however, a quantity of *x* is also carried about, more particularly by the excrement; *x*, in fact, clings to its products just as yeast cells cling to a fermented liquid. And whenever *x* meets with fresh *y*, it generates fresh *z*; and so the epidemic travels on, *x* making itself felt by *z* whenever it falls upon a store of *y*. For the existence of *y*, certain things are necessary, to wit:—

1. A soil which, like alluvium, is permeable to air and water for several feet deep.
2. A rise and fall of sock-water. A soil which is permanently dry, or one which is always filled with sock-water, are equally unfavourable for the development of *v*. The change of level of water is absolutely necessary.
3. The presence of organic and mineral matters on which the variations in the amount of sock-water may act, and out of them produce *y*.
4. A temperature suitable for such processes of organic evolution.

All these points and many others are fully discussed in a series of chapters with such headings as "Porous and Compact Soils"; "The Soil and the Immunity of Wirzburg"; "Influence of drinking Water on Cholera epidemics"; "Considerations on the Cholera epidemic of 1866 in East London, in reference to Soil and Sock-water conditions"; "Apparent evidences against the 'Soil and Water theory' and for the theory of 'Contact and Idiosyncrasy,'" &c. &c. It concludes with a series of aphorisms, "On the Origin and Spread of Cholera"; "On the Influence of Variations in Sock-level on the Enteric Fever of Munich"; and, "On the Causes of the Immunity of Lyons."

SOCIETIES AND ACADEMIES.

Zoological Society.—The first scientific meeting for the session will be held on Thursday the 11th inst., when Prof. Flower, F.R.S., will read a paper on the Anatomy of the Aard-Wolf (*Proteles cristatus*). The following communications have been received since the last meeting:—Dr. J. Anderson: Letter received from, describing a living specimen of the Pigmy hog of Terai (*Porcula salvania*).—Mr. P. L. Sclater: Remarks on the condition of various Zoological Gardens on the Continent recently visited by him, and on new and rare animals observed in those establishments.—Dr. B. Simpson. Notes on *Ailurus fulgens*.—Mr. John Brazier: Note on the Egg of a species of *Megapodius* from Bank's Islands.—Surgeon Francis Day: Remarks on fishes in Calcutta Museum.—Mr. John Brazier: Notes on the Localities of two Species of Land-Shells.—Mr. R. B. Sharpe: Additional Notes on the genus *Ceyx*.—Dr. George Bennett: Letter received from, on the habits of the Wood Hen of Lord Howe's Island.—Dr. J. E. Gray: On the Guemul or Roe Buck from Tinta, South Peru.—Dr. A. Günther: Report on two collections of Indian Reptiles.—Mr. Morton Allport: Letter received from, on the introduction of Salmon into the Australian Colonies.—Rev. O. P. Cambridge: Notes on some Spiders and Scorpions from St. Helena, with descriptions of new species.—The Secretary: On additions to the Menagerie during June, July, August, and September.—Mr. W. T. Fraser: Letter received from, respecting the Existence of the Rhinoceros in Borneo.

MANCHESTER.

Literary and Philosophical Society, October.—Mr. E. W. Binney, F.R.S. in the Chair. The following extract of a letter from Dr. Joule, F.R.S., dated Southport, October 5th, 1869, and addressed to the Chairman, was read:—"I enclose a rough drawing of the appearance of the setting sun. Mr. Baxendell noticed the fact that at the moment of the departure of the sun below the horizon, the last glimpse is coloured bluish green. On two or three occasions I have noticed this, and also near sunset that just at the upper edge, where bands of the sun's disk are separated one after the other by refraction, each band becomes coloured blue just before it vanishes."

PARIS.

Academy of Sciences, October 25.—M. L. Pasteur communicated a note relative to the dispute which has arisen between him and M. Thenard on the subject of his patented process for preserving wines by the application of heat. A paper was read by M. Phillips on the Movement of similar solid Elastic Bodies, supplementary to a memoir on the equilibrium of such bodies, read in January last.

A memoir on the fundamental Equations of the mechanical theory of Heat, by M. F. Reech, was presented by M. Regnault. In a note on the illumination of transparent bodies by polarised Light, M. A. Lallemand described some new experiments with transparent solids. On passing a ray of polarised light horizontally through a polished cube of glass in a direction perpendicular to two of its faces, the maximum of illumination is horizontal, the light emitted is white, is entirely polarised in a horizontal plane, and gives the principal lines of the solar spectrum. When viewed vertically, the illumination is nil, unless the glass be fluorescent. The light observed in a vertical direction in the latter case is more or less coloured, is neutral to the polariscope, and gives none of the lines of the solar spectrum. The author noticed the behaviour of various other substances, such as crystal, fluor spar, Iceland spar, &c., M. Dumas communicated a letter from M. P. Volpicelli on the Heat of the Lunar Radiation containing an historical sketch of the researches upon this subject, and showing that both Melloni and Herschel have demonstrated the calorific action of the Moon. M. H. Marie Davy, whose previous statement (September 20, 1869) that the calorific effects of the Moon's rays were inappreciable called forth M. Volpicelli's remarks, now communicated a note on the Calorific Power of the Lunar Rays, in which, after noticing that Melloni was the first to demonstrate the existence of such a power, and that his results had been confirmed by Prof. Piazzi Smyth; he goes on to describe his own recent experiments, in which, by the employment of the thermoelectric pile, he has been able to obtain a series of results perfectly confirmatory of those of his predecessors. He found that the heat furnished by the moon is quite appreciable, and that its amount increases rapidly as it advances towards the full. M. C. Dareste communicated a memoir on the notion of Type in Teratology, and on the distribution of monstrous type in the division of vertebrate animals; the argument of which is, that the type of monstrosities is correlated with the type of organisation, so that if uniformity of type occurs in monstrosities throughout any wide range in all classes of the vertebrata, for example, the origin of such monstrosities dates from a very early period of embryonic development, and the more limited the range of a monstrosity, the later in the life of the embryo will be its origin. A paper was read by M. P. P. Dehérain on the influence exerted by different luminous rays upon the decomposition of carbonic acid and the evaporation of water by leaves. The author states that, with equal intensity, the yellow and red rays act more energetically than the blue and violet rays, both in producing evaporation, and in causing the decomposition of carbonic acid; in the latter respect he found that the leaves of *Potamogeton crispus* emitted 26·2 cub. cent. of gas under yellow light; they gave off only 5·8 cub. cent. in the same time under blue rays of equal intensity. M. E. Decaisne communicated some remarks on the various conditions of the production of goître; M. Landrin, a note on the physiological action of Chloral; M. Jaliwski, an account of a process for bronzing iron; M. Delaurier, a note on the manufacture of manganate of calcium, and M. Mehay, a note on the Infinitesimal Calculus.