A COCHIN-CHINA REMEDY FOR LEPROSY

A NOTE in NATURE (vol. xxi. p. 19) refers to a remedy for leprosy, obtained from Cochin-China, but the origin of which is imperfectly known. Its name is given as *hwang-nao*. In Mr. Consul Tremlett's Report (For. Off. Repts. No. 21, p. 1237) it appears as *hoang-nau*. We have taken a good deal of trouble about this drug at Kew, and the inclosed extract from the Kew Report for 1877, p. 31, contains all that has been positively ascertained about it at present:—

"*Hoâng-nan, a Supposed Remedy for Leprosy*.—Mr. Prestoe, Superintendent of the Trinidad Botanic Garden, has drawn my attention to some accounts given in *Les Missions Catholiques* for 1875, describing the surprising efficacy of a drug, the produce of a plant found in Cochin-China, in the treatment of leprosy and rabies. The plant is known by the name of Hoâng-nan, and the description, which is of the vaguest kind, represents it as a climber, and its bark as the efficacious portion.

"M. L. Pierre, the Director of the Botanic Garden at Saigon, has obtained an imperfect specimen of the Hoâng-nan, and informs me that he identifies it as a new species of *Strychnos*, which he has named *S. gautheriana*, in honour of the ecclesiastic who first gave the virtues of the Hoâng-nan a wider publicity.

"M. Pierre adds some remarks which appear to me worthy of placing on record:—'The bark of *Strychnos nux-vomica* is regarded in Cambodia and Siam as a poison no less certain than that extracted from the seeds. The natives have remarked the fact, which is also believed to hold good in the case of cinchonas, that the bark has the most powerful properties when it has been covered with moss or otherwise protected from the action of light.' In collecting the bark great attention is paid in consequence to the circumstances under which it has been produced." W. T. THISELTON DYER

SOME POINTS IN THE HISTORY OF SPECTRUM ANALYSIS[1]

A PHYSICAL problem begins like a rivulet. At its first introduction it is small and seemingly unimportant—constantly however, as it winds along it receives accessions from various quarters until at length it becomes a mighty river that is finally merged in the unfathomable ocean. This course is followed by all such problems. Each begins small—grows broader and will finally bear us on to the unknown if we trust ourselves to its guidance.

I need hardly remind you that the demonstration of the decomposition of white light was one of the triumphs of the illustrious Newton. But like other problems it had its small beginning. We find in one of the earliest memoirs of the Royal Society, a paper on "The Genuine Method of Examining the Theory of Light and Colours," by Mr. Newton. Here he asks amongst others, the following questions:—

(1) Whether rays that are alike incident on the same medium, have unequal refractions?

(2) Whether rays endued with particular degrees of refrangibility, when by any means separated, have particular colours constantly belonging to them, viz., the least refrangible scarlet, the most refrangible deep violet, the middle sea green; and others other colours?

(3) Whether colours by coalescing do really change one another to produce a new colour, or produce it by mixing only?

(4) Whether a due mixture of rays, endued with all variety of colours, produces light perfectly like that of the sun? and he ends by remarking that the most proper and direct way to a conclusion is to determine such queries by experiment. Then follow some objections to the theory of light and colour, by the Rev. F. Pardies and Mr. Newton's reply to these objections. Into the nature of these however, it is not my purpose to enter. Let me rather adopt Newton's suggestion and bring the experiment itself before you.

You are all, no doubt, familiar with the operations of the photographer, and as a matter of fact you know that when the light from a natural object is made to pass through his lens an image of this object is impressed upon the sensitive plate placed at the focus at the other side of the lens.

If the natural object be a friend's face you obtain his photograph, if it be a tree, you get the image of the tree, if it should be a bright slit of light or a bright wire you would get the image of the slit of light or of the wire. Now here we have a slit which is rendered luminous by an intense light thrown upon it, and if we place a photographer's lens before it we shall obtain an image of the slit. You see the image thrown upon a screen and you see moreover that the light is white; it is in fact the electric light which illumines the slit. For the machine by which this light is produced our college is indebted to the generosity of Mr. Wilde. But my object is not now to discuss the electric light, but to show you that it is white and like the light of the sun—since, as you see, its image on the screen is white. Let us now interpose a prism or train of prisms between the lens and the screen. These prisms will do two things. In the first place they will bend the rays towards the base or thick part of the prisms so that in order to catch the image the screen must be moved in this direction. But in the second place they will bend some rays more than others;—if the slit be lighted by pure red light it will be least bent, if by orange, this will be more bent than the red, if by yellow this will be more bent than the orange, then follow green, blue, indigo, and violet, the latter of which is most bent.

Now if the light behind the slit be a mixture of red, orange, yellow, green, blue, indigo, violet, we shall have a series of images of the slit overlapping one another, and forming a long ribbon of light of which the portion least bent will be coloured red and that which is most bent will be violet. Let us now see what we get from the light we are using. Here you see we have all the colours of the rainbow, red, orange, yellow, green, blue, indigo, violet, and therefore our light must contain all these; but our light was white like that of the sun and thus you see we are entitled to say that white light is composed of a mixture of these various colours.

In fact what we have done by the prism has been to separate these various constituent rays from one another and throw one on one part of the screen and the other on another part. . But now if we make these various constituents to dance so quickly before our eyes that we get a united impression of the whole, we shall imagine once more that we have white light. We separated the rays in space—let us now combine them in time—and you see the thing is white. We have thus demonstrated the composition of white light after the way by which the chemist proves the composition of water, first decomposing it by the battery into oxygen and hydrogen, and then causing these two gases once more to recombine. I will now remind you that light consists of waves or undulations given out by the luminous body. These waves take place in a medium called ether, surrounding us all, in which they proceed with incredible swiftness. The light given out by a luminous particle may thus be compared to the note or notes given out by a bell. In solids and liquids however the particles are so closely packed together that they may be likened to a number of different bells all tied together in such a way that the total mass is capable of giving out every, or almost every, variety of note. From an incandescent solid or liquid body, when sufficiently hot, you thus get every variety of light, and

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[1] Being an address delivered by Dr. B. Stewart, F.R.S., at the opening of the present session, to the Natural Philosophy Classes at Owens College.

it is particles of carbon, probably in the solid state, that in the electric light afford us every variety of ray so as to enable us to get from them a continuous spectrum. When, however, we go from solid and liquid particles to those of a gaseous nature, we find the various molecules so far apart that each one is unconstrained by its neighbour; it is thus like a bell left to itself, in which case it gives out its own peculiar kind of light just as a bell, left to itself, will give out its own peculiar note. I will now show you on the screen the various rays or luminous notes given out by particles of incandescent vapour of silver.

We thus see what is the spectroscopic difference between solids or liquids, and gases, the former when sufficiently heated giving out a continuous spectrum consisting of all different rays of light, the latter a discontinuous spectrum consisting of only a few different rays.

The next point to which I will call your attention is a very important one. A particle when cold or comparatively cold absorbs those very rays which it gives out when hot. Now it is known that incandescent vapour of the metal sodium, gives out under certain conditions a peculiar monochromatic yellow light, which we call the double line D. This light is so strictly monochromatic that all bodies under its illumination appear either yellow or black, as you will see by the following experiment.

Now suppose we take the electric lamp, the carbon points of which, as you already know, give out all kinds of light, and suppose we place between these points a piece of metallic sodium; while this sodium is in the act of being volatilised, and its vapour comparatively cold, you will see that it will stop one particular kind of light, and will thus cause a black line. When, however, the vapour is sufficiently hot, this black line will be changed into a bright yellow one You thus see that when we have an incandescent body which gives us all rays, and when between it and the eye we insinuate some comparatively cold sodium vapour, we get a certain definite black absorption line.

Now the curious point is that the sun's light gives us this black line, so that if I could replace the electric light by the sun, I should have a black line thrown upon the screen in the very position where you saw it when the sodium was introduced.

This means that between the source of the sun-light and the eye, we have sodium vapour in a comparatively, remember only comparatively, cold state, and as this vapour is certainly not in the earth's atmosphere, it can only be in the atmosphere of the sun. I need not tell you that although colder than the particles beneath it which give us sun light, it must be in reality very hot. The discovery that there was vapour of sodium in the atmosphere of the sun was due to Stokes, and it has since been found out by Kirchhoff that we have black lines in sun light corresponding in position with the bright lines of iron vapour, the bright lines of hydrogen, the bright lines of magnesium vapour, and the bright lines of many other elements, and we may therefore assume as Kirchhoff assumed, as a first and approximative hypothesis, that the vapours of iron, magnesium, hydrogen, &c., as well as that of sodium exist in a comparatively cold state in the atmosphere of our luminary;—more recent work by Huggins and others has shown that the same remark applies to the atmospheres of many other stars.

You thus see that there are two ways by means of which the chemical composition, or rather perhaps the atomic structure of bodies may be indicated by the spectrum. At a comparatively low temperature this structure will be indicated through the lines that are absorbed or rendered black, while at a comparatively high temperature it will be indicated by the bright lines that are given out.

Thus at a comparatively low temperature a solution which contains blood will indicate the presence of this substance by certain very peculiar black lines. Blood, however, is easily decomposed by a high temperature, and accordingly when such is applied we no longer get the bright equivalents of these black lines, but something very different, namely, the bright lines of iron, and of those other elements into which blood is decomposed as the temperature is raised. In short when raising the temperature of a substance its black lines will be converted into bright ones only in those cases where no molecular change has taken place between the two temperatures. Even in the case of elements like sodium Roscoe and Schuster have shown that the absorption spectrum at a low temperature is different from, and more complex than, the radiant spectrum at a high temperature, and other elements have been tried in this way by Lockyer and others with similar results. We may imagine with much propriety that the molecule of sodium vapour at a low temperature is a larger and more complex structure than it is at a high temperature, where the splitting up or dissociating agency of heat has been freely employed.

We come at last to the important question which it is my object to discuss. Has a study of the spectrum thrown any light on the ultimate constitution of matter, or is it likely to do so?

You are aware that chemists and physicists have begun to speculate as to the possibility that the so-called elements may be in reality nothing more than combinations differing in numbers and in tactical arrangement, of some one kind of primordial atoms.

This idea was first entertained by Dr. Prout, the well-known physician and chemist. He pointed out that the atomic weights of the so-called elements are very nearly all multiples of the half of that of hydrogen, so that the various elements may possibly be looked upon as formed by a grouping together of certain atoms of half the mass of the hydrogen atom.

M. Stas, the distinguished Belgian chemist, instituted a laborious series of experiments with the view of testing this doctrine. He came to the conclusion that the atomic weights of the various elements were not precisely multiples of the half of that of hydrogen, there being greater differences than could possibly be accounted for by errors of experiment. His researches, however, seemed to show that in many cases there was a very near approach to Prout's imagined law. But here we must bear in mind the great difficulty, or indeed impossibility, of obtaining substances absolutely free from all impurities (indeed Dumas showed that oxygen forms part of the silver with which Stas worked), so that we may be excused from imagining that Stas has settled the point in the negative. We are thus driven to look to the spectrum as a likely means of throwing some light on this very interesting and important speculation.

Let us now, therefore, endeavour to realise what would be the behaviour of the spectrum if the so-called elements were not capable of simplification, and also what would be its behaviour if they were, and then find with which of these two hypotheses the true behaviour of the spectrum agrees best. Now if the elements were absolutely simple bodies, we might still expect that the molecule of vapour of an element would be at a low temperature more complex than at a high one, and would therefore give out a more complex spectrum. As, however, the temperature was made to rise we might expect ultimately to obtain a certain spectrum which would represent the simplest mode of vibration of that element, and which would thenceforward remain, however much higher the temperature should be made to mount. Lockyer has written much on this point and given many facts in support of this view.

And again we should have no reason for supposing that the lines of the ultimate spectrum of one element should coincide in position with those of the ultimate spectrum of another element. If therefore we had a mixture of all the elements, and subjected this mixture to a very high temperature, the resulting spectrum under the supposition that each element is really an element, would never be simpler than the combined spectra of the various elements.

On the other hand, if the elements were really compounds of some one primordial atom, we might expect that a very high temperature would split up their atomic structure, and simplify their spectra, so that at an enormously high temperature a mixture of all the elements might nevertheless give us a very simple spectrum. We might likewise expect that different elements might split up into common constituents, so that at a very high temperature the spectra of these elements would have certain lines in common.

It is in the larger masses of the Universe, the sun and stars that we must look to find a mixture of all kinds of matter at very high temperatures, and when we have a brilliant bluish-white star containing a large proportion of the more refrangible rays we have every reason for supposing this star to be at a very high temperature. Now such stars exhibit an extreme paucity in the black lines which appear in their spectra, in which there is hardly anything else than certain prominent lines seen in the spectra of hydrogen, calcium, magnesium, and sodium. Lockyer, who has devoted great attention to this subject, argues therefore as follows. If it be true that as a rule the atmospheres of the whiter and presumably hotter stars contain fewer elements and those of the smallest atomic weight and that as stars diminish in whiteness their atmospheres rise in complexity of structure this undoubtedly tells in favour of the power of high temperature to split up the so-called elements. He has quite recently carried this reasoning into another field. The Fraunhofer lines give us the integration of the absorptions of all the strata of the solar atmosphere. Now spot phenomena occur in a restricted stratum of this atmosphere, and this stratum is low and therefore hotter than the overlying portions. We can tell the spectral lines special to a spot by their widening, and the number of lines widened is small in comparison with the Fraunhofer lines. Here again we have simplicity brought about by high temperature in the low levels in the sun as in the stars hotter than the sun.

Let us now ask whether the spectra of the various elements have or have not certain lines in common. It used to be imagined that they had not.

When, however, they have been examined under great dispersive power there has been found reason to qualify this assertion. There are certain lines in the spectra of each element which appear long and thick, their predominant notes as it were, and it has been found that while such a line for instance is exceedingly prominent in some one element other elements appear to possess it, only not nearly so prominently. Lockyer's argument from this was that, on the assumption that the elements are truly elementary, the line in the other elements was caused by traces of impurity. He has, however, recently had reason to believe that there are coincidences between the spectra of the various elements not of this nature. There are coincidences of lines which are not the prominent lines of any one spectrum and they give no signs of that variability of brightness that might be expected to characterise lines due to impurities. These lines he has called basic lines. As may be readily imagined in a branch of knowledge which is so new we shall have long to wait for facts. Hence we cannot test this conclusion by referring to the spectra of stars. But Lockyer has already shown that we can test it by means of the spectra of sun-spots, and here the facts are certainly in support of it. The basic lines are more prominent in the spectra of spots than in the spectrum of the sun generally, and further they are more prominent at epochs of sun-spot maximum than during times of minimum.

But we must have a clear conception of what we mean when we suppose that the so-called elements are split up at a very high temperature.

If we apply a very powerful source of electricity we obtain certain peculiar lines from the vapour of calcium.

Now if we could (like the Demon of Maxwell) catch hold of and segregate—put into a box as it were all these minute entities that give us this suspicious line at a high temperature, and further if we could keep their high temperature up I think it is probable that we might obtain something which is not calcium, or at any rate, something simpler than the molecule of calcium as this appears at lower temperatures. But we are not yet able, and perhaps we may never be able, at an ordinary temperature to present the chemist with some other substance derived from calcium which is not calcium.

To conclude there seems little doubt that spectrum analysis will, as it advances, throw great light on the ultimate constitution of matter and it therefore justifies the remarks which I made at the commencement of this lecture.

THE SWEDISH NORTH-EAST PASSAGE EXPEDITION

DESPATCHES have been received by Mr. Oscar Dickson, of Gothenburg, from Prof. Nordenskjöld, giving an account of the wintering of the *Vega*, down to April 1; letters from Lieut. Palander and other members of the North-East Passage Expedition have also been published, some of them bringing down the narrative to a later date. From these we gather the following particulars:—

The *Vega* was frozen in on September 28, in 67° 7′ N. lat. and 173½° long. W. from Greenwich, at the northernmost extremity of Behring's Straits. The land in the neighbourhood forms an extensive slightly rolling plain, bounded on the south by gently-rising hills, which, farther into the interior, are said by the natives to reach a considerable height. The plain is occupied to a large extent by lagoons separated from the sea by low sandy beaches. When the *Vega* was frozen in, the ground was covered with hoar frost and frozen, but still free of snow, so that it was possible to form some idea of the flora of the region. Close to the beach, compact beds of *Elymus* were intermixed with carpets of *Halianthus peploides*; next there stretched a poor level gravelly plain, only covered with a black lichen, *Gyrophora proboseidea*, and some few flowering plants, amongst which *Armeria sibirica* was the most common. South of this, again, was a tract occupied by lagoons and small lakes, whose shores were covered with luxuriant vegetation, consisting of grasses and *Carices*. On the neighbouring high ground, where the soil, derived from weathered strata of gneiss and dolerite, is richer, the vegetation is marked by greater variety. Here were thickets of willows, extensive carpets of *Empetrum nigrum*, and *Andromeda tetragona*, and large tufts of a species of *Artemisia*. Here were found also the frozen remains of the red whortleberry, the cloudberry, *Taraxacum officinale*, and other plants peculiar to the high north. In an excursion to the interior on October 8, Lieut. Nordquist observed that on the driest parts of the *tundra* the most common plants were *Aira alpina* and *Poa alpina*; on the lower places, *Glyceria*, *pedicularis*, and *Ledum palustre*. *Petasites frigida* and a species of *Salix* occurred everywhere, the latter growing in large compact masses covering spots several hundred square feet in extent, the bushes in some places being 3 to 4 feet high.

In the neighbourhood of the *Vega's* winter quarters there were six small encampments, numbering from three to twenty-five tents each, inhabited by Tchuktches to the number of about 200. With these natives there was much friendly intercourse. They were allowed free access to the deck from which, though covered with a multifarious