local practitioner who derived his livelihood by the goodwill of the local landlord?

Prof. Hewlett also denounced the way in which chemists were taking upon themselves the bacteriological examination of pathological material, and emphatically asserted that disease problems should be dealt with only by medical men. He also advocated that a course of biology should be obligatory for candidates for the associateship of the Institute of Chemistry taking the subject of biological chemistry.

An interesting discussion, opened by Dr. Newman, of Finsbury, was on the possibility of establishing a bacteriological standard of purity of milk. Dr. Newman suggested the following standards:—(*a*) not more than 24–25 degrees of total acidity at the time of sale, 1 degree being equivalent to 1 c.c. of deci-normal NaOH solution; (*b*) not an excess of pus or blood; (*c*) no *B. coli, B. enteritidis*, or *B. enteritidis sporogenes*; (*d*) non-virulent to guinea-pigs. All the speakers, including Dr. Allan Macfadyen, Prof. Kenwood, Dr. Savage, Colonel Firth, Mr. Revis and others, agreed that there was little possibility at present of fixing a standard, and Dr. Newman's suggestions did not obtain general acceptance.

Another discussion, on the relative efficiency of chemical and bacteriological methods for the examination of sewage effluents, was opened by Mr. Dibden and by Dr. Savage. There was a general agreement that chemical methods gave a better indication of proper purification than bacteriological ones, though, of course, bacteriological methods alone were of service in detecting species of micro-organisms.

Lieut. Nesfield, I.M.S., gave an interesting demonstration of a method devised by him for the sterilisation of drinking water during a campaign. He had found that chlorine in the proportion of 2 grams per 100 gallons acting for five minutes effectually destroyed the organisms of cholera, typhoid, and dysentery. His method consisted in carrying iron bottles of liquid chlorine, from which, by means of a valve, the requisite amount was liberated into the water. After five minutes a powder of sodium sulphite (2·2 grams) was added to the water, from which a double decomposition ensued, and the water was rendered absolutely tasteless. For the soldier on the march another method was devised, so that he could sterilise for himself a gallon of water. This consisted in adding to the vessel of water a tablet containing iodide and iodate of sodium. This resulted in the liberation of free iodine in the water, which acted in five minutes as an efficient germicide, and was then "killed" so that the water was rendered potable, by the addition of another tablet of sodium sulphite. In both processes the quantities of reagents employed are so small as to have no effect on the human economy; the methods are rapid, and the reagents, &c., portable.

ECLIPSE SHADOW BANDS.

ONE of the most peculiar appearances attending a total eclipse of the sun is that generally known as the "shadow bands." They are long dark bands, separated by white spaces, which are seen on the ground or sides of buildings just before and just after the total phase of an eclipse, moving rapidly. It is probable that they are not real bands, but are composed of dark patches which seem to the eye to make long bands. Their cause is not yet clearly known, as the observations in former eclipses are quite discordant. The undersigned is very desirous of obtaining observations of them at various stations along the line of totality, especially at places near the edge of the shadow, in order to compare with similar observations made by himself and others. The observations require no special instruments, and can be made by any careful person. Information is desired upon the following points:—(1) the direction in which the bands lie; (2) the direction in which they move; (3) the velocity with which they move; (4) the width of the bands; and (5) their distance apart. All of these are likely to be different before and after the total phase, so that two sets of observations are needed. The following suggestions are compiled from various sources.

Spread a white cloth or piece of canvas upon the ground in any convenient open space. It is well to spread *two* cloths or pieces of canvas, one to be used before, the other after, the total phase. Let each observer be furnished with several sticks, 4 feet to 6 feet long.

About three minutes before the time of totality, let the observer stand near the cloth with his back to the sun and watch the cloth intently. If bands or dark patches are seen, place one stick down in the direction in which they lie; after this is done place a second stick in the direction in which they are moving. Both of these operations should be done deliberately, not hurriedly, and the sticks left in position.

During the total phase the observer is free to enjoy the scene or make other observations, but it may be well to note if any bands can be seen during totality, as some have asserted.

At the close of totality the observer should be at the second cloth, or at another part of the single cloth (if he uses but one), and should repeat the observations made before totality, placing one stick down in the direction in which the bands lie, and another in the direction in which they move.

It will be seen that four sticks are needed for these observations. If two persons make the records, one should confine his attention to the direction in which the bands lie, the other to the direction in which they move. The bands are likely to be somewhat faint and poorly defined, so that extreme accuracy may not be possible.

The sticks should not be disturbed until after the eclipse, when their direction should be determined with as much care as possible, either by a compass or, still better, by a surveyor's theodolite if one is available. If neither compass nor theodolite is at hand, an estimate of the directions should be made.

The velocity with which the bands travel is more difficult to determine. The estimates vary from the speed of a man running to that of an express train. Several methods may be suggested:—

(1) Let two persons work together, one having a watch with the seconds marked on the face. Let him mark time by calling out each second. The number of the second is not important, but a simple sound to mark the seconds is sufficient. Let the other observer watch the bands and see how many he can count per second.

(2) With one observer marking time as before, let the second observer note how many seconds elapse while a band is passing between two objects the distance apart of which is known.

(3) Let a person run a short distance with the bands and see if he can keep up with them. If not, let him estimate how much faster the bands are moving than he can run.

(4) A mere guess at the speed is of some value.

The width of the bands and their distance apart can best be determined upon the cloths mentioned above, and it will add to the accuracy of the estimates if the cloths are divided by seams or in some other way into strips of known width. A carpenter's rule will aid the observer in making the estimates. The bands will probably be several inches wide and separated by spaces the width of which is the same or greater.

If the observer notices any other point connected with the bands, such as their colour, whether they are straight or wavy, whether they are continuous bands or made up of dark patches, whether they flicker or not, the information will be valuable. Still more valuable would be photographs of the bands as they pass over the ground or the side of a building or wall.

It is earnestly requested that anyone who will kindly attempt the above, either in whole or in part, will send his records to the undersigned. If for any reason the observation seems unsatisfactory, either because the bands were not as distinct as expected, or for any other reason, or if the record is only fragmentary, it will still be of value. The report should consist of a statement of the methods employed by the observer or observers in making the observations, and the results obtained, with any remarks upon the subject or upon other phenomena noted at the time of the eclipse. A. LAWRENCE ROTCH.

Blue Hill Observatory, Hyde Park, Mass., U.S.A.

The observations may be summarised as follows :—

OBSERVATIONS OF SHADOW BANDS, AUGUST 30, 1905.

Place ....

(Situation and altitude)

Observers ....

....

	Before totality	After totality
1. Direction of bands,	....	....
2. Direction of motion,	....	....
3. Velocity,	....	....
4. Width of bands,	....	....
5. Distance apart,	....	....

Remarks :

Direction of the wind before totality....................., after totality....................., and direction from which upper clouds (if any) came.....................

THE LATENT IMAGE.[1]

MY inclination has led me, in spite of a lively dread of incurring a charge of presumption, to address you principally on that profound and most subtle question, the nature and mode of formation of the photographic image. I am impelled to do so, not only because the subject is full of fascination and hopefulness, but because the wide topics of photographic methods or photographic applications would be quite unfittingly handled by the president you have chosen.

I would first direct your attention to Sir James Dewar's remarkable result that the photographic plate retains considerable power of forming the latent image at temperatures approaching the absolute zero—a result which, as I submit, compels us to regard the fundamental effects progressing in the film under the stimulus of light undulations as other than those of a purely chemical nature. But few, if any, instances of chemical combination or decomposition are known at so low a temperature. Purely chemical actions cease, indeed, at far higher temperatures, fluorine being among the few bodies which still show chemical activity at the comparatively elevated temperature of $-180°$ C. In short, this result of Sir James Dewar's suggests that we must seek for the foundations of photographic action in some physical or intra-atomic effect which, as in the case of radio-activity or fluorescence, is not restricted to intervals of temperature over which active molecular *vis viva* prevails. It compels us to regard with doubt the *rôle* of oxidation or other chemical action as essential, but rather points to the view that such effects must be secondary or subsidiary. We feel, in a word, that we must turn for guidance to some purely photo-physical effect.

Here, in the first place, we naturally recall the views of Mr. Bose. This physicist would refer the formation of the image to a strain of the bromide of silver molecule under the electric force in the light wave, converting it into what might be regarded as an allotropic modification of the normal bromide which subsequently responds specially to the attack of the developer. The function of the sensitiser, according to this view, is to retard the recovery from strain. Bose obtained many suggestive parallels between the strain phenomena he was able to observe in silver and other substances under electromagnetic radiation and the behaviour of the photographic plate when subjected to long-continued exposure to light.

This theory, whatever it may have to recommend it, can hardly be regarded as offering a fundamental explanation. In the first place, we are left in the dark as to what the strain may be. It may mean many and various things. We know nothing as to the inner mechanism of its effects upon subsequent chemical actions—or at least we cannot correlate it with what is known of the physics of chemical activity. Finally, as will be seen later, it is hardly adequate to account for the varying degrees of stability which may apparently characterise the latent image. Still, there is much in Mr. Bose's work deserving of careful consideration. He has by no means exhausted the line of investigation he has originated.

Another theory has doubtless been in the minds of many. I have said we must seek guidance in some photo-physical phenomenon. There is one such which preeminently connects light and chemical phenomena through the intermediary of the effects of the former upon a component part of the atom. I refer to the phenomena of photo-electricity.

It was ascertained by Hertz and his immediate successors that light has a remarkable power of discharging negative electrification from the surface of bodies—especially from certain substances. For long no explanation of the cause of this appeared. But the electron—the ubiquitous electron—is now known with considerable certainty to be responsible. The effect of the electric force in the light wave is to direct or assist the electrons contained in the substance to escape from the surface of the body. Each electron carries away a very small charge of negative electrification. If, then, a body is originally charged negatively, it will be gradually discharged by this convective process. If it is not charged to start with, the electrons will still be liberated at the surface of the body, and this will acquire a positive charge. If the body is positively charged at first, we cannot discharge it by illumination.

It would be superfluous for me to speak here of the nature of electrons or of the various modes in which their presence may be detected. Suffice it to say, in further connection with the Hertz effect, that when projected among gaseous molecules the electron soon attaches itself to one of these. In other words, it ionises a molecule of the gas or confers its electric charge upon it. The gaseous molecule may even be itself disrupted by impact of the electron if this is moving fast enough and left bereft of an electron.

We must note that such ionisation may be regarded as conferring potential chemical properties upon the molecules of the gas and upon the substance whence the electrons are derived. Similar ionisation under electric forces enters, as we now believe, into all the chemical effects progressing in the galvanic cell, and, indeed, generally in ionised solutants.

An experiment will best illustrate the principles I wish to remind you of. A clean aluminium plate, carefully insulated by a sulphur support, is faced by a sheet of copper-wire-gauze placed a couple of centimetres away from it. The gauze is maintained at a high positive potential by this dry pile. A sensitive gold-leaf electroscope is attached to the aluminium plate, and its image thrown upon the screen. I now turn the light from this arc lamp upon the wire gauze, through which it in part passes and shines upon the aluminium plate. The electroscope at once charges up rapidly. There is a liberation of negative electrons at the surface of the aluminium; these, under the attraction of the positive body, are rapidly removed as ions, and the electroscope charges up positively.

Again, if I simply electrify negatively this aluminium plate so that the leaves of the attached electroscope diverge widely, and now expose it to the rays from the arc lamp, the charge, as you see, is very rapidly dissipated. With positive electrification of the aluminium there is no effect attendant on the illumination.

Thus from the work of Hertz and his successors we know that light, and more generally what we call actinic light, is an effective means of freeing the electron from certain substances. In short, our photographic agent, light, has the power of evoking from certain substances the electron which is so potent a factor in most, if not in all, chemical effects. I have not time here to refer to the work of Elster and Geitel whereby they have shown that this action is to be traced to the electric force in the light wave, but must turn to the probable bearing of this phenomenon on the familiar facts of photography. I assume that the experiment I have shown you is the most fundamental photographic experiment which it is now in our power to make.

[1] Address to the Photographic Convention of the United Kingdom, 1905. By J. Joly, F.R.S.