"Recent Views on Colour." By Albert H. Abbott, B.A.

(Read January 29, 1898.)

The colour problem has three aspects :

I. The physical problem, which investigates that energy in nature which is especially connected with our sensation of light and colour.

II. The physiological problem, which investigates the processes in the eye and its accessories as the organ of vision.

III. The psycholcgical problem, which investigates our sensations of colour, or colour as it is experienced. The question here is: What are the mental facts of light and colour, and on what conditions do they depend ?

The first " recent " view on colour discussed was the emphasis which has been laid upon this psychological colour problem with the rise of scientific or experimental psychology. Both of the other aspects, the physical and physiological, must refer continually to the facts of colour which scientific psychology discovers or establishes, as the final test of the adequacy of their theories. The facts of all sciences are *primarily* facts for psychology (*i.e.*, psychic or mental facts), and *secondarily*, facts for these sciences, and hence, the conclusions and theories of all sciences must be judged by their faithfulness to the facts of experience.

The second view on colour discussed was a modification to the ordinarily accepted physical theory of colour, suggested by Dr. Kirschmann. The ordinary theory contends that colour is an explicit function of the wave length. There is a difficulty, however, in this view which is raised from the fact that *no one has ever seen light or a colour of only one wave length*, and, therefore, that, could we get light of one wave length, there is no guarantee at all that we should see it coloured. *Colour of one wave length is a purely hypothetical conception;* at every point on a spectrum there is always a superposition or interaction of wave lengths. A slit *infinitely* small would, so far as mathematics are concerned, give the *pure* spectral colours which advocates of this theory demand : but, on the other hand, a plate bearing a slit which is *infinitely narrow* would be for us an *opaque* object. Colour as seen in the spectrum must actually be projected by use of a slit of finite width, and, therefore, it must always be produced by the superposition or interaction of wave lengths.

This contention is based directly on psychical considerations, viz., whether we *see* colour or not. To contend that that alone would be a *pure* colour which is to be produced under circumstances which would prevent us seeing either light or colour seems to overlook the fact that it is our sensations of colour which make any science of optics possible, and surely they must be the deciding factor in such a matter to the last.

A second line of objection to the theory that colour is an explicit function of the wave length arises in connection with the discussion regarding purple, *i.e.*, the colour which would form the transition from violet to red. This colour is not present in the ordinary spectrum, and from this it has been concluded that purple is not a *pure* but a *mixed* colour, and as such it is not a constituent of white light at all.

An experiment was shown which seems to have some bearing on the question. By very simple means two spectra were thrown upon a screen together, parallel and in close juxtaposition to each other. The one was the ordinary spectrum, consisting of red, orange, yellow, green, blue, violet, and the second was an "inverted" spectrum, consisting of blue, violet, purple, red, orange, yellow. (Note.—Purple is absent from the first, *green is absent from the second.*)* This "inverted" spectrum

* The "inverted" spectrum was first shown in this connection in a lecture given by Dr. Kirschmann before the Mathematical and Physical Society of the University of Toronto. The objection may be raised that the colours in the inverted spectrum are not as "pure" as those in the ordinary spectrum, but this is met by the fact that, as sensations, the colours are quite as pure and brilliant as the ordinary spectral colours. The right of these colours to rank physically the same as the latter colours was further demonstrated in the above-mentioned lecture by the fact that both spectra show interference bands equally well.