The entries of "all cases" and of "tricolours observed" in Table V are deduced from Table I, by combining the appropriate columns. The letters at the top show which columns are combined.

Seven other observed cases, disposed in three groups, are scattered beyond the limits of Table VI; two of these seven cases are tricolour.

"Further Note on the Influence of a Magnetic Field on Radiation Frequency." By OLIVER LODGE, F.R.S., assisted by Mr. BENJAMIN DAVIES. Received May 19,—Read June 3, 1897.

Referring to a former communication of mine, on the subject of Zeeman's discovery, printed on page 513 of the 'Proceedings of the Royal Society' for February 11 this year, vol. 60, No. 367, I wish to add an observation to those previously recorded, as I have recently acquired a concave Rowland grating ($3\frac{1}{2} \times 1\frac{1}{2}$-inch ruled surface, 14,438 lines to inch, 10 feet radius of curvature, being the one used by Mr. George Higgs), of which the spectra of the first and third orders on one side are very satisfactory.

It is said on page 513, "If the focussing is sharp enough to show a narrow, dark reversal line down the middle of each sodium line, that dark line completely disappears when the magnet is excited." With the greater optical power now available the dark reversal line is often by no means narrow, and though in some positions of the flame it does still tend to disappear or become less manifest when the flame is subjected to a concentrated magnetic field, the reason of its partial disappearance is that it is partially reversed again—*i.e.*, that a third bright line, as it were, makes its appearance in the midst of the dark line, giving a triple appearance to each sodium line.

More completely stated the phenomena are as follows:—After obtaining each sodium line with a prominently double aspect by manipulating the flame, the magnet is excited, and the dark band in the midst of each sodium line is then seen to widen out considerably in the region of most intense magnetisation, while a bright intrusion line makes its appearance. On closer examination this new line is seen to be double, by reason of a dark division down its middle; and I apprehend that with still more magnetic power this dark band might itself open out into two; but this last phenomenon I have not yet observed.

The whole sodium group is thus seen as if it were octuple. The effect is not due to a mere mechanical disturbance or rearrangement of the gases of the flame by the agency of magnetism; because a nicol, placed in the rays emanating transversely to the magnetic lines of force, cuts off nearly all the visible magnetic effect when oriented so as to get rid of light whose plane of polarisation contains the lines of force—that is, of oscillations or revolutions whose electrical components are across or around the magnetic lines. That it does not cut off every trace of the effect appears to be due to the fact that the field of force is not strictly uniform, and so its lines are not strictly parallel.

The following is a summary of the different appearances that may be seen according to the state of the flame and the strength of the field:—

At low temperature, and with the flame forward in the field, when each sodium line is sharp and single, magnetism widens it, and with a little more power doubles it, causing a distinct dark line down its middle. The same effect occurs with lithium and thallium lines.

At higher temperature, and with the flame partially behind the field, when each sodium line appears as a broad hazy-edged double, magnetisation greatly widens the doubling, pushing asunder the bright components very markedly; stronger magnetisation reverses the middle of the widened dark band, giving a triple appearance; stronger magnetisation still reverses the middle once more, giving a quadruple appearance to the line. In every case a nicol, suitably placed, cuts off all the magnetic effect and restores the original appearance of the line.

A curious circumstance is that although both lines, D_1 and D_2, show the effect, D_1, *i.e.*, the less refrangible line, shows it best and most sharply. I should describe the effect on D_2 as a coarse widening of considerable amount, but without very clear definition; whereas the widening of D_1, though perhaps no greater in amount, is decidedly better defined. There is no doubt but that, with my grating, D_1 is the line at which one finds oneself usually looking in order to see the details of the change best; and I can hardly suppose this to be subjective to the grating. I hope to show the effects at the soirée next Wednesday.

[The same thing is seen when salts of lithium or of thallium are introduced into the flame; and the components of the doubled red lines are more widely separated than the components of the doubled green lines, the effect being proportional to wave-length. The most interesting line to try was the red cadmium line, since this has been proved to be of specially simple constitution by Michelson. We have recently been able to get the cadmium spectrum well developed by means of a sort of spark arc between the magnet poles, maintained by an induction coil excited by an alternating machine; and we find that the magnetic doubling of the chief lines occurs in precisely the same way with the spark spectrum as with the flame spectrum, and that the red cadmium line behaves in the same way as the others. The magnetic effect is better seen, from a direction perpendicular to the line of force, when a nicol is interposed in the path of the light, but rotation of the nicol through 90° cuts it entirely off, accurately so when a small spark is the source of light.—May 31.]

Fifth Report to the Royal Society Water Research Committee.

By H. Marshall Ward, Sc.D., F.R.S., F.L.S., Professor of Botany in the University of Cambridge. Presented to the President and Council, December 10, 1896.

(Abstract.)

The following is a short *résumé* of the principal points resulting from three years' study of the Bacterial Flora of the Thames.

All the forms have been grown on gelatine, agar, and potato, as well as in broth, milk, and sugar-solutions, and some of them in special media in addition. Moreover, most of them have been cultivated in hanging drops under the microscope, sometimes isolated and under high powers, for long periods, and the course of development of the colonies traced in detail in several cases, and even when this could not be successfully carried to a conclusion, information as to the changes and growth of the organisms has been obtained, which helps to throw light on their behaviour and relationships.

This work has occupied a long time, and these water bacteria do little beyond growing and dividing, so that in many respects this part of the work only starts problems for the future. In some cases, however, the morphological changes observed are helpful in explaining the macroscopic appearances of the colonies, and in any case it is clear that no examination of a bacterium can be considered complete until its life-history has been traced under the microscope.

The number of forms isolated and cultivated amount to eighty, not counting the large number which were either rejected at an early stage as certainly duplicates, or lost during cultivation.

Of these eighty forms some have been distinctly recognised as well known types, *e.g.*, *Bacillus membranaceus amethystinus* (Eis.), *B. fluorescens liquefaciens* (Fl.), *B. fluorescens non-liquefaciens* (Fl.), *B. coli commune*, *Proteus vulgaris* (Haus.), *Bacillus arborescens* (Fr.), *B. prodigiosus* (Ehr), *B. termo* (Cohn), *B. subtilis*, and *Sarcina lutea*.

Others have been referred with less certainty to less well known forms, such as *Bacterium ureæ* (Jaksch), *B. fulvus* (Zimm.), *B. aureus* (Adam.), *Ascococcus* (Cohn), *Micrococcus carneus* (Zimm.), and *M. candicans* (Fl.).

The remainder are either new, or only doubtfully identified as already described forms, or evidently varieties of some of the foregoing.

During the progress of the cultures, large numbers of coloured drawings were made, with the intention of affording means of identification, but it was found that variations are so numerous and so large, that some study of these variations had to be undertaken.

This led to an investigation of the growth of the colonies in gelatine and other media, and an attempt to explain why, and how far, the colonies vary in culture. This necessitated a careful examination of the factors concerned in the development of the shapes, markings, movements, and so forth of the colonies themselves, and to a classification of the characters furnished by these colonies.

One outcome of the above studies was the conviction that two sets of factors are at work in causing the variations found in the colonies. First, the slight variations in the food-materials, temperature, moisture, &c., which cannot be avoided, however carefully the work is done; and, second, variations in the bacterium cell itself as it comes from the river, owing to the exigencies it has been subjected to during its sojourn there. The water of the river is, in fact, a very dilute and indefinite food solution, and just as changes occur when we remove a bacterium from broth to milk or to gelatine, so do such result when we transfer from the river to these media, and the changes induced in all cases depend on how long the bacterium has been in the one medium or the other, as well as upon other factors.

The river water is a very poor food medium, and so we cannot be surprised that in many cases the recently isolated bacteria behave as weakened forms; the recognition of these enfeebled varieties suggests explanations of many of the bad "species" in the literature of water bacteria. My work goes to show, not that species cannot be made out, but that the limits of the species are, in most cases, far wider than is assumed in descriptions—in other words, that many so-called species in the books are merely varietal forms, whose characters, as given, are not constant, but depend on treatment. How far this is true for any given case will have to be tested on the particular form in question.

Very slight variations in rapidity of growth of the individual bacterium, its power of liquefaction, pigment production, capacity of fermenting, and so on, lead to comparatively very great differences in the appearance of the colonies formed in a given time on, or in, a medium like gelatine, the composition, aëration, hygroscopicity,