

cusses the position of their colouring matter and ascribes the waterproof character of certain cell membranes to the deposition of excreted fatty or waxy substances, pointing out that this waterproof character is of importance biologically,

"since it prevents the penetration of toxic substances from the surrounding aqueous medium, and thereby also opposes the attempts of the mycologist to kill such fungi by means of aqueous toxic solutions."

A chapter is devoted to the mineral nutrient matter utilised by the Eumycetes, the author indicating that certain substances which are not absolutely necessary for the nutrition of these organisms may still, as in the case of nickel, cobalt, and manganese, like iron, exert a stimulative action on the growth of fungi. Sulphur, selenium, and silicon may also be found in the protoplasm of these fungi, but phosphorus appears to be a most important element in their composition, and, although arsenic does not take the place of the phosphorus in the Eumycetes, certain of these organisms appear to have the power of converting arsenious acid into volatile compounds having an odour of garlic. These organisms have, therefore, been used for the purpose of indicating the presence of arsenic in cases where, by the ordinary Marsh's tests, only a doubtful reaction has been obtained. The influence of light on the development of the Eumycetes is discussed, and it appears that although strong light interferes with their development, moderate illumination interferes very little with their activity. Chemotropism is discussed somewhat fragmentarily; this remark applies also to the diastatic enzymes and the enzymes capable of decomposing fat; the enzymes of yeast, however, are described more fully in the later part of the work.

The special part of the book consists of two sections, one devoted to the fermentation set up by Zygomycetes, the other to a preliminary consideration of yeast-fermentation. The first of these sections is interesting to the technologist from the fact that it deals with Calmette's *Amylomyces Rouxii* or *Mucor Rouxii*, derived from the Chinese yeast-balls used in the preparation of rice spirit. This produces a powerful diastatic enzyme which first produces glucose, and this, in the absence of oxygen, is converted by yeast ferment into alcohol. For a full account of the *Amylomyces* process the reader may be referred to the description of the use of the *Mucoræ* in the spirit industry.

The latter half of part i. of vol. ii. is devoted entirely to yeasts, especially the forms, structure, and chemical composition of the yeast-cell, and anyone who studies this will be amply repaid by obtaining a knowledge of the principles and mechanism of fermentation such as can be obtained elsewhere only by the study of bulky treatises, though now and again one is a little disappointed that the author has not elaborated his descriptions somewhat more fully, this remark applying specially to the chapter on the chemistry of the yeast-cell. The sketch given is so interesting that one would have welcomed a somewhat more detailed account of this part of the work.

After reading this work one feels the truth of Hansen's statement that none of the text-books and

manuals giving a summary of larger or smaller sections of technical microbiology has treated the subject of this extensive field from so comprehensive a point of view as that of Dr. Lafar. In preparing the work, the author has exhibited not only many sided discernment and enthusiasm for his task, but also great courage and endurance. Certainly, this part of the second volume

"will be welcomed not only by those for whom it is primarily intended, viz., technical chemists, chemists dealing with food stuffs, fermentation and agriculture, pharmacists, and agriculturists, but many another worker will derive benefit from its pages for his lectures and researches."

We can cordially recommend this section of Dr. Lafar's work as an excellent supplement to the first volume, which has already been reviewed in our columns.

We are glad to learn that the translators have made arrangements with the German publishers to obtain advance proofs of the German work in order that the concluding sections may appear as soon as possible. This portion of the work fully maintains the interest aroused by the first volume, and the translators are to be congratulated on the fact that they have been able to give so accurately not only the substance, but the spirit of the German work.

G. SIMS WOODHEAD.

VISUAL PURPLE.

Abhandlungen zur Physiologie der Gesichtsempfindungen. By J. von Kries. Heft. i., 1897, pp. vi+198; Heft. ii., 1902, pp. 197. (Leipzig: Johann Ambrosius Barth.)

THIS is a collection of papers reprinted from the *Zeitschrift für Psychologie und Physiologie der Sinnesorgane*. The papers are the work of von Kries and his school, and deal chiefly with visual purple and its functions. They give an account of one of the most important of recent advances in our knowledge of the physiology of sensation.

The discovery of visual purple in 1876 aroused great hopes, which seemed to be frustrated when it was found that the substance was absent from the *fovea*, the place of most distinct vision, and physiologists soon settled down to the view that a substance absent from this situation could have little to do with the production of visual sensations.

In the early days, however, Kühne suggested that the great instability of visual purple made it probable that it was a substance for the perception of feeble light, and Parinaud in France later advanced the same idea. It has been reserved for von Kries to develop fully Kühne's idea.

According to von Kries, visual purple is a substance which supplies the retinal basis for vision at low luminosities, and the accumulation of this substance is accountable for the great increase in sensitiveness of the dark-adapted eye—a thousand-fold increase according to some computations.

The change in the relative brightness of different colours with varying illumination, first pointed out by Purkinje, finds a ready explanation on this view.

Hering had shown that this phenomenon is a function of the condition of dark-adaptation produced by feeble illumination rather than a function of the feeble illumination itself, and von Kries shows that the changes of relative brightness are readily explicable if we suppose that, as the eye becomes more and more dark-adapted, there comes into play a new factor which has no influence, or no appreciable influence, at ordinary luminosities. Speaking roughly, the blue end of the spectrum becomes relatively brighter, and it is this end of the spectrum which has the greater action on visual purple.

In pronounced dark-adaptation the spectrum is seen as a colourless band of light, and the curve of luminosity of the spectrum in this condition shows a close correspondence with the curve representing the degree of action of different parts of the spectrum on visual purple. The spectrum is shortened at the red end; it is brightest in the green, and the diminution of brightness towards each end is much more gradual on the blue than on the red side of the maximum.

Visual purple also furnishes an explanation of an anomaly of colour vision which has long puzzled physiologists. A colour-equation which is good for one luminosity is not good for all luminosities, and von Kries shows that the mixed light which becomes relatively brighter at low luminosities is that which has the greater action on visual purple.

The absence of visual purple from the *fovea centralis* provides a ready method of putting the theory to the test. If dark-adaptation with its influence on colour-brightness and colour-equations be due to visual purple, the *fovea* should not share in the increased sensitiveness of the dark-adapted eye, nor should this region show any change in colour-brightness or in colour matches in different conditions of adaptation.

There seems to be no doubt that the *fovea* responds in favour of the theory. There is some difference of opinion as to whether this region fails entirely to show alteration of sensitiveness, but it is generally agreed that any increase which occurs is insignificant compared with that of the surrounding region of the retina. Very careful observations by Nagel and others seem also to show conclusively that Purkinje's phenomenon and the alteration of colour-matches are absent if the stimulation of the retina be strictly limited to the foveal region. The features of colour vision which are believed to depend on visual purple are absent just when, according to the theory, they should be absent.

One of the most interesting developments of the theory is that in which the condition of total colour-blindness is regarded as vision dependent chiefly, or exclusively, on the visual purple of the rods. Hering was the first to show that the curve of luminosity of the spectrum in most cases of total colour-blindness corresponds with great exactness to the curve of luminosity of the normal dark-adapted eye, and von Kries shows that there are other points of close resemblance between the two conditions.

If visual purple be the basis of monochromatic vision, there ought to be a central blind spot, and in several cases which have been examined from this point of view by quite independent observers, this has been found to be the case. Again, the behaviour of

the *fovea* is in favour of the theory. The evidence here, however, is not unanimous. Hess has failed to demonstrate the existence of a central scotoma in several cases, but our knowledge of the exact distribution of rods and cones in the human *fovea* is based on very few examinations, and it is possible that there are wide individual variations, and that in some people a small area devoid of rods may be absent, or so small that it is impossible to demonstrate its presence. The diffusion of visual purple into the rod-free area is also possible in some cases, but it seems more probable, from a study of the evidence as a whole, that there are two kinds of total colour-blindness, and that in only one of these is it probable that visual purple is the only sensitive substance in the retina.

Several of the papers in the "Abhandlungen" deal with the recurrent image, or "ghost" of Bidwell, which is believed by von Kries to be a "visual purple" phenomenon. This part of von Kries's work has been much attacked, and recent work seems to show that the recurrent image is a much more complex phenomenon than has usually been supposed. It is probable that visual purple is only the basis of one of the elements of the complex.

The comparative evidence is in favour of the theory, visual purple being abundant in nearly all vertebrates the habits of which are nocturnal or which live underground.

It has only been possible here to give the briefest sketch of the views of von Kries and his co-workers. The "Abhandlungen" should be consulted for the elaborate investigations and detailed arguments in support of their views.

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OUR BOOK SHELF.

Botanische Forschungen des Alexanderzuges. By Dr. H. Bretzl. Pp. xii+412. (Leipzig: Teubner, 1903.) Price 12 marks.

THE criticism passed by Sachs in his "History of Botany" on the writings of the ancient classical writers, including Theophrastus, seems to have been unnecessarily severe where he passes over their "corrupt texts" with a brief mention. At that time the study of geographical and ecological botany had not received the stimulus which was mainly induced by the appearance of Schimper's master work, "Die Pflanzengeographie." It would hardly be going too far to say that it required the development of this branch of the subject to admit of the full appreciation of Theophrastus's work. For the essential feature of Theophrastus's "Plant Geography," and this book is the main source of information concerning Alexander's expedition, is the painting of a series of word pictures, illustrations of types of vegetation, in which, while correct morphological ideas could hardly be looked for, the descriptions, in their accuracy of observation and power of expression, are not often excelled by those due to present-day writers. As might be expected, some of the accounts are difficult of explanation, and discrepancies arise which have demanded considerable skill and enthusiasm on the part of Dr. Bretzl to clear up. Others are more obvious; thus the paragraph which begins:—

"ὑποβέβρωται δὲ ταῦτα τὰ δένδρα πάντα κατὰ μέσον ὑπὸ τῆς θαλάττης καὶ ἔστηκεν ὑπὸ τῶν ῥιζῶν ὥσπερ ποδύπους" calls up very definitely the picture of a mangrove swamp.