

those of igneous origin, many important rock-forming minerals, like the garnets, are not among those figured. The preface of the book suggests that it is not intended to take the place of an ordinary text-book, but to supply the information which is not given in such works, being left for the laboratory-demonstrator to supply—and this would seem to be the limit of the book's usefulness.

Famous Chemists. By E. Roberts. Pp. 247. (London: G. Allen and Co., Ltd., 1911.) Price 2s. 6d.

It seems a little difficult to understand the object of writing a series of disconnected short biographies of distinguished chemists now that we have several readable histories of chemistry of moderate compass in which biography is woven into connected narrative. At the same time it must be stated, after conscientiously reading the book from cover to cover, that these biographical epitomes are well done. The chief contributions of each master are clearly indicated, and the human touches on the whole artistically added. Boyle hardly has his due proportion, and Berthelot and van't Hoff are not included at all.

Perhaps the chief thing to be said for this compact gallery of chemists is that it may help to stimulate an interest in history, and lead the reader to a more thorough study of the life-work of the great men who have made chemistry what it is. This is an educational and liberalising side of chemical study which in the past has been much neglected. It is a pure convention, and a mischievous one, that isolates the study of natural philosophy itself from the study of its history.

A. S.

Earth and her Children. By Herbert M. Livens. Pp. 248. (London: T. Fisher Unwin, 1912.) Price 5s. net.

MR. LIVENS practises the art of teaching nature study by means of pleasant little stories in which plants and animals speak autobiographically. The nature knowledge imparted in the twenty-four chapters into which the book is divided is much diluted by the conversational matter introduced, but the stories will please many children, and may lead a few to observe nature for themselves.

LETTERS TO THE EDITOR.

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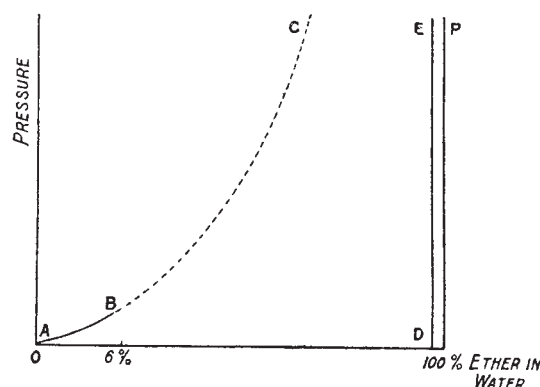
Osmotic and Liquid Membranes.

IN an interesting letter in NATURE of February 22 Lord Berkeley has considered the question of a possible osmotic cycle in which a liquid such as ether is placed at the same time in connection through membranes with an aqueous solution of sugar and with water, while the latter is also in similar connection with the solution.

The water is kept at zero pressure, while the ether and the solution are at the osmotic pressure of the latter.

As a consequence of a view of osmotic membranes which I have lately ventured to put forward in a paper in the Proc. Roy. Soc., he quite correctly deduces that equilibrium should exist for different strengths of the sugar solution provided the pressure is its osmotic pressure, and in addition that the ether should hold the same amount of water in solution at the different pressures. Or, to quote his words, "the same solution of water in ether has two different osmotic pressures." This he regards as impossible.

Perhaps the best way to consider this question is to examine first the simple case of water placed on either side of a membrane permeable to water, but not to ether, and to suppose ether gradually added to one side. The osmotic pressure will rise, as shown by AB, to a maximum value at about 6 per cent. of ether. No solution of greater strength than this is possible until we reach 98.95 per cent. The osmotic pressure is now again zero, but rapidly rises, as shown



along DE, approaching the pressure axis P asymptotically; so that practically without any concentration change we can have any osmotic pressure we please.

The dotted curve has been added to show the normal character of the curve for substances which dissolve in all proportions, and probably if the pressure on both sides of our membrane were raised to a sufficiently high value the two portions of the ether curve would unite somewhat after the fashion of the Van der Waals's isothermals, and ultimately form the normal case, because experiments (not yet published) show that the portion DE moves to the left under pressure.

If the above experiment be supposed repeated, but with sugar in solution on the other side of the membrane to that to which the ether is added, the first possible strong solution of ether is greater than 98.95 per cent., or DE is moved to the right. As in the case of water, so in the case of sugar solution, DE can be moved to the left by raising the pressure on both sides of the membrane. For a 60 per cent. solution of sugar the pressure to bring it back to its old position is 80 atmospheres.

Returning now to Lord Berkeley's cycle, we are in a position to see how equilibrium can exist without an appreciable change in strength of the ether solution when different strengths of the sugar solution are used. Referring to his figure, equilibrium exists across membrane *bd* at the osmotic pressure of the solution when the concentration of the ether is 98.95 per cent., and practically the same concentration is required for equilibrium at the membrane *bc*, no matter what the pressure may be.

Perhaps I may add that the view of osmotic membranes which I wished in my paper to emphasise is that a substance which acts as ether does in the condition at DE can, so long as the mechanical strength