rats under the conditions obtaining in New Bedford were bearing at the rate of from three to four litters per year.

Limitation of numbers in nature is thus seen to be accomplished by a restriction of the reproduction rate as well as through the action of natural enemies. In other words, a physiological limit is imposed probably through the influence of nutrition. Trapping or poisoning merely serves to increase the available food supply for survivors.

PAUL EATON,
C. S. STIRRETT

AUGUSTA, GEORGIA
NEW BEDFORD, MASS.

VITAMIN B

Now that the vitamin originally known as "Vitamin B" has been definitely shown to be made up of at least two other vitamins, this laboratory has devised a method of separating these vitamins from each other and thus leaving them in a liquid form which can be easily used.

When these two fractions are fed alone and separately from the basal diet there is only a slight stimulation of growth for two or three weeks and then a gradual decline, but when the two are fed together there is a moderate rate of growth. This rate of growth, however, is not what one expects from the amount used (equivalent to 1.0 gm of original yeast daily) nor is the rate of growth comparable to that produced by the original yeast. In looking about for an explanation it was thought that possibly the yeast-residue contained the missing factor. A check lot of rats was given this yeast-residue, but instead of a good growth there was slight growth for about two weeks and then a decline and death. However, when these two other vitamins were added to the yeast-residue and the same fed to rats, excellent growth resulted. This new substance found in the yeast-residue after the two other vitamins have been removed meets all the definitions of a vitamin. It appears to be thermostable, and insoluble in water. It activates the two other vitamins of the vitamin-B complex and causes a greater growth than the two alone.

CHAS. H. HUNT

OHIO AGR. EXP. STATION,
WOOSTER, OHIO

WHAT IS OSMOSIS?

THE recent edition of the text-book of General Botany by Holman and Robbins states:

> The word osmosis has been given such a variety of meanings by those who have used it that it has lost any precise meaning whatever. As far as possible we shall avoid its use.

That it has been badly used, or rather misused, is evident, but should it be abandoned for this reason? The word is applied to a very definite physical phenomenon and has an exact meaning regardless of whether it has been misused or not.

Examination of standard text-books of botany reveals the source of the present status of the term. A single illustration will suffice. One widely used text states:

> Diffusion through a membrane is osmosis. When two fluids (liquids or gases) of different densities are separated by a porous membrane, diffusion through the membrane will take place until equilibrium results. The diffusion will be more rapid from the less dense to the more dense fluid.

The use of the term *dense* in this connection is meaningless. Students usually interpret it in terms of viscosity, a condition unrelated to osmosis. If it be considered to mean specific gravity then again the definition will not account for the direction of movements of all materials, for the dissolved salts of an egg, to use the illustration given in connection with this definition, will diffuse out into the water in which the egg is immersed at the same time water diffuses in. In this case, however, the movement is from the egg or "denser" medium, to the water or "less dense" medium. Therefore, the "law" is not applicable and consistent for the relatively simple example used to illustrate the process.

Any discussion introducing such terms as "dense solution," "less dense solution," "weaker solution," "stronger solution," and similar descriptions of the concentration of materials in a solution is entirely misleading and can but cause confusion.

A clear statement of the principles involved should remove all possibility of misunderstanding and restore to usage a term too important to be discarded.

In the first place osmosis follows the simple law of diffusion in that the direction of major movement of any material is determined by the concentration, *i.e.*, the number of molecules or ions of that material. The general direction of movement is always from a region where the diffusing material is higher in concentration of particles. The particles of the diffusing material are moving in *both* directions through the membrane, but more are moving away from the position in which most are found than are returning.

Materials move independently of each other, no matter how heterogeneous the solution in contact with the membrane may be. In no case are the diffusing particles dependent on the movement of water or any other material for their own movement.

Osmosis, then, can be defined briefly and accurately as diffusion through a membrane, the direction of

major movement being from a region of high concentration to a region of low concentration of the thing diffusing.

Such a definition will apply to all cases of the phenomenon, no matter how complicated. It is easily applied and avoids the misconceptions introduced by the use of inexact terms.

ORTON K. STARK

UNIVERSITY OF WYOMING

A NOTE ON THE PREPARATION OF BIOLOGICAL SPECIMENS BY FILTRATION OF PARAFFIN

IT is only recently that the writer has seen and read No. 233 of the *American Museum Novitates*. This contains an article written by Dr. G. K. Noble and M. E. Jaeckle and entitled "Mounting by Paraffin Infiltration." Naturally I am interested in learning how these authors received the first suggestions of the possibilities of the method and how they have, with diligence and ingenuity, brought it to a high stage of efficiency.

A special reason for my interest in the matter arises from the fact that I may regard myself as the original inventor of the process. In Volume XIX of the *American Naturalist*, issued May, 1885, on page 526, I detailed the manner in which I filled all the tissues of various small animals with paraffin. Among these were small turtles, fishes, lizards, salamanders, mussels and earthworms. Noble and Jaeckle employ some media which were not at my command, but the result to be attained is the same. I congratulate them on their success.

It appears to the writer that economy of time might be effected, especially in the case of the larger specimens, by more use of injections of the hardening and clearing fluids into the body cavities, perhaps also into the alimentary tract, that seat of rapid putrefaction, and even into the blood-vessels. Certainly freshly-killed animals of moderate or large size will in warm weather begin to decay and become bloated by gases before the preserving formalin or alcohol can penetrate the skin and muscles.

OLIVER P. HAY

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

SCIENTIFIC BOOKS

Alcohol and Longevity. By RAYMOND PEARL. Knopf, New York, 1926, pp. xii + 273.

NOT only Professor Pearl's "Friends of the Saturday Night Club" to whom he dedicates this work, but his other friends and indeed the whole alcohol-interested public will find matter of great importance in this volume. It records a unique investigation in human life statistics and makes the results clear, even for the non-scientific reader. Doubtless many careful readers, who are students of the problem, will be surprised at Professor Pearl's finding on page 226:

> "In a fairly large and homogeneous sample of the working population of Baltimore the moderate drinking of alcoholic beverages did not shorten life. On the contrary moderate steady drinkers exhibited somewhat lower rates of mortality, and greater expectation of life than did abstainers."

The problem of the effect of alcohol on the duration of human life is inherently such that we must turn to large groups for our observations and "to the mathematics of large numbers, to the theory of mass phenomena, to interpret safely our observations." Few if any scientific workers to-day doubt the metabolism results of Atwater and Benedict in reference to the utilization of alcohol in the human body. These results have recently been further extended by Carpenter[1] at the Nutrition Laboratory, who has administered alcohol in the form of rectal enemata and finds the same promptness of oxidation as his predecessors. In the well-known study by Dodge and Benedict on the psychological effects of single doses of alcohol it is pointed out that taken the world over there are very many people who "regularly obtain a somewhat larger proportion of their total energy requirement (calories) from alcohol than from protein." Moreover, it is generally agreed now that alcohol is not a stimulant but a depressant. The results of many studies, including those by Dodge and Benedict and more recent ones by the reviewer, have shown that even small or moderate single ingestions of dilute alcoholic beverages tend to slow up and disarrange reflex and voluntary functions particularly at the time when the alcohol in the blood is on the increase. From these results it appears that we have in alcohol an environmental factor which the body can handle at least in moderate quantities, a contribution to nutrition that needs no digestion, that can to some extent replace other food, but that has a characteristic effect on the central nervous system. As a rule, people take alcohol not so much for its calories as for its colorful relaxing influence on mental life. But it is recognized as

[1] Carpenter, Thorne M., "Human Metabolism with Enemata of Alcohol, Dextrose, and Levulose." Carnegie Institution of Washington, Washington, 1925, Pub. No. 369.