Determinations of the rate of digestion of gelatine solutions introduced into excised caeca showed an optimum at about 6.7. The degree of digestion was followed by Van Slyke's method for amino-nitrogen, taking samples from the medium surrounding the caeca after the gelatine had been introduced. In the controls it appeared that scarcely any amino-nitrogen is produced naturally by the caeca in spite of the intense ciliary activity. As CO_2 is produced quite abundantly, oxidation of fat is suggested as the source of energy.

Using the pH change as a proper measure of CO_2, it was apparent that CO_2 production was most vigorous at pH about 6.7. In the more alkaline media CO_2 production is gradually diminished with further departure from this normal pH. Below pH 6.7 the production appears practically to cease, a condition coincident with rapid death.

The existence of an optimum condition of hydrogen ion concentration at a point different from sea water shows the existence in the organism of a regulatory process. In the production of this optimum either added HCl or the H_2CO_3 produced by its own metabolism is effective in securing the favorable condition. It appears from the fact that some of the favorable media were in equilibrium with the CO_2 of the air, while others contained a higher tension of CO_2, that the optimum point is not a matter of increased facility of CO_2 elimination because of the development of a greater CO_2 tension within the caeca. It is apparently a true optimum for CO_2 production by the tissue itself, irrespective of the particular conditions of CO_2 elimination.

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The carbonic acid-carbonate equilibrium in sea water.

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Ca, Mg, and CO_2 in sea water are the common constituents which are most variable in quantity. The condition of these substances is sensitive to the slight changes of the ocean, in con-

trast to the stability of soluble neutral salt forming substances. They are, furthermore, concerned in a direct way with vital reactions. CO_2 is also one of the most important indicators of vital activity and the suitability of the solution for organisms because it is a product of destructive metabolism and a means for the fixation of energy. If the carbonic acid-carbonate system is considered distinctly, it is conspicuous first that it requires time to equilibrate sea water with a gas phase containing CO_2. If acid or alkali is added to sea water, a number of hours aeration will be required before a constant pH is attained with any tension of CO_2.

Bubbling and shaking sea water with pure hydrogen slowly increases the pH to about 9.2. This is about the point found by Atkins and others as the limit for photosynthetic activity of several marine algae. After acidification and bubbling to remove CO_2, an alkali titration curve lags below the curve for a base of the same concentration as the excess base of sea water (0.0025 N). Such a curve shows the buffer effect of non-volatile buffers alone. A direct acid titration shows the combined buffer effect of both volatile and non-volatile weak acids.

Titration curves at various CO_2 tensions differ from those for pure carbonate solutions in requiring more acid. Taking this difference as a measure of the buffer effect of other weak acids than carbonic, their apparent dissociation constant is calculated as $k = n \times 10^{-8}$. L. J. Henderson's artificial sea water was 0.0015 M in boric acid, but boric acid is not reported so abundant in sea water. Silica is reported in a concentration sufficiently large to have this effect if it behaves like an acid as weak as boric. This point is not revealed with the existing data, but there is suggested an important topic because of the presence of silicon in many organisms and geological processes.

Because sea water contains other weak acids than the volatile carbonic acid, its pH may be varied by the addition of acid and the change fixed at any CO_2 tension if aeration with CO_2 at that tension is continued until the equilibrium is established. If the equilibrium condition is not considered, there can be no determination of the effect of various water samples used on metabolism because of the uncertain resistance of the solution to CO_2 elimination.