ous parts, though dealing with a remote region, are of great interest to American students. This will be understood from the citation of some of the titles, such as: Rock-destroying organisms in relation to Coral Reefs; The Zooplankton; Copepoda; Larvae of the Decapod Crustacea; Mollusca (a very large report, of which part 1 has appeared).

(4) *The John Murray Expedition of 1933–34.* Five volumes have been appearing in parts. The region surveyed was the Indian Ocean and the Gulf of Aden, full use being made of the echo-sounding machine, which made possible the detailed mapping of the ocean floor. In addition to the purely oceanographic work, very large collections of the marine animals were made, and I have before me detailed reports on such groups as the Cirripedia, pelagic Hemiptera, Pennatulacea, Amphipoda, Scyphomedusae, Polychaeta, Asteroidea, Phyllirhoidae, Pteropoda, Penacidae, Opisthobranchia, Astacura and Palinura, Pycnogonida and Corals.

The above account does scant justice to the activities of the British Museum, but the reader will get some idea of the volume of the work and the liberal policy with regard to publication. As I write, the news from Europe is extremely discouraging, and it is to be feared that the torch of science, if not extinguished, will be so dimmed as to shed little light or will blaze anew in creating means of destruction. Progress in human affairs, within the period of my recollection, has been so great and in most respects so admirable that it is hard to understand how any reasonable individual or group of individuals can fall under the influence of social pathology, nullifying the good that has been done, and might so easily continue in ever-increasing volume. The return to social health and sanity will no doubt eventually occur, but how soon and in what manner? In the meanwhile, scientific workers will carry on as circumstances may permit.

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SPECIAL ARTICLES

NOTE ON WATER IN NON-AQUEOUS SOLUTIONS

IN various models designed to imitate living cells the cell surface is represented by guaiacol, which acts very much like certain protoplasmic surfaces. In such models the behavior of water presents interesting features and it is desirable to ascertain to what extent they occur in the living cell.

The following example serves to illustrate the situation. To a two-phase guaiacol-water system at equilibrium at 25° C. we add increasing amounts of trichloroacetic acid and find that the concentration of water in the guaiacol phase steadily increases while its activity in this phase decreases.[1] When its concentration has increased 12 times its activity coefficient falls to less than 1/12 of its value before acid was added.[2,3] This indicates an attraction of the acid for the water.[4]

At the same time the activity coefficient of the guaiacol in the aqueous phase falls off nearly as much, indicating an attraction of the acid for the guaiacol.

Since the acid can attract both water and guaiacol it is able, when added in sufficient quantity, to make the two phases fuse into one.

A number of other systems follow this pattern, as is evident from the literature.[5] Substances which act like trichloroacetic acid (in other systems) are other organic acids, lower alcohols, acetone, phenols, aniline hydrochloride and pyridine.[5]

Trichloroacetic acid in diffusing through the guaiacol phase appears to carry water with it. Water moves from an aqueous solution where the concentration, mole fraction, vapor pressure and activiity of water are low to one where they are high. A variety of factors must be considered in this connection.[4]

One interesting feature is the following. Let us suppose that a diffusion cell is set up and that the diffusion reaches a steady state so that the concentration gradient of acid in the guaiacol phase may be represented by a fixed straight line, as in Fig. 1.

We may then represent the concentration gradient of water as in Fig. 1, since it is obvious in shaking experiments that for each concentration of acid there is a definite concentration of water.

The concentration gradient of acid is due to flux of acid, but that of water need not be due to flux of

[1] This is shown by the fact that as the guaiacol phase takes up more water it comes into equilibrium with a series of aqueous solutions with decreasing vapor pressure of water.

[2] The activity coefficient of water in the guaiacol phase before acid is added may be regarded as $f_w = a_w \div c_w$ where a_w is the activity and the c_w the concentration of water in the guaiacol phase. When acid is added the vapor pressure of the water in the guaiacol phase, p_w, falls to $p_w\ (x)$, where $x < 1$. When enough acid has been added to raise c_w to 12 c_w and to lower a_w to $a_w\ (y)$, where $y < 1$, and f_w to f'_w we have $f'_w = a_w(y) \div (12c_w)$.

[3] We have been unable to find similar calculations for other systems in our preliminary exploration of the literature, but data exist which might be employed for this purpose.

[4] This will be discussed in a forthcoming article in the *Journal of General Physiology*.

[5] *Cf.* "International Critical Tables," 3: 398 *ff.*, McGraw-Hill Book Co., Inc., New York, 1928, where various diagrams show that as the non-aqueous phase (which is not guaiacol) takes up more and more water it comes into equilibrium with aqueous phases containing less and less water just as in the guaiacol-water-trichloroacetic acid system.

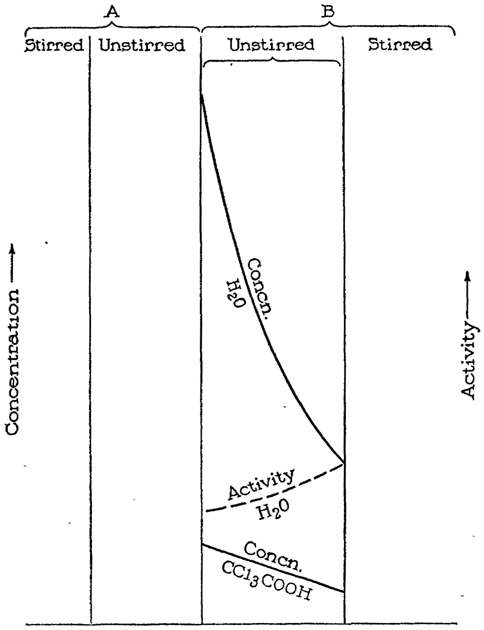

FIG. 1

water; there might conceivably be no flux of water or a flux in either direction.

Since the activity of water in the guaiacol phase falls off as its concentration increases it would seem that we may draw the activity gradient of water in the guaiacol phase as shown by the broken line in Fig. 1.

These considerations may help to explain some of the puzzling cases met with in the living organism.

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CEREBRAL METABOLISM DURING FEVER[1]

THE treatment of general paresis with hyperthermia, initiated by Wagner-Jauregg in 1887, is now an accepted form of therapy. In some manner fever facilitates the action of specific treatment in the cerebral form of syphilis. In an attempt to elucidate this question, the brain metabolism of patients with general paresis was studied before and during fever produced by injections of typhoid vaccine and inductotherm therapy. Samples of arterial blood and of the return flow of the brain obtained from the internal jugular vein were analyzed for oxygen, carbon dioxide, glucose and lactic acid. The changes of cerebral blood flow were estimated from the variations of blood pressure and the velocity of the general circulation as determined by the objective cyanide method of Robb and Weiss.[2] The circulation rate through the brain is largely influenced by the changes of the general circulation.[3]

Complete studies were obtained on 7 patients after typhoid vaccine and 7 during fever therapy with inducto-therapy. Table I presents typical effects of

TABLE I

Experiment	Temperature (°F.)	Oxygen A–V difference (Vol. %)	Velocity of blood (Sec.)	Mean blood pressure Mercury millimeter
1.	98.0	5.15	17.6	132
	100.4	6.55	11.0	126
	102.0	6.63	10.0	113
	104.4	7.61	13.0	101
	106.0	9.14	7.4	103
2.	98.8	6.93	15	108
	105.4	7.88	11	79
	105.3	7.09	4	75
3.	98.6	7.75	20	110
	105.0	15.82	17	112

fever on the oxygen A-V difference, velocity of the blood and mean blood pressure. In 11 of 15 observations the oxygen A-V difference rose from 2.0 volumes per cent. to 8.1 volumes per cent. In 12 of 15 experiments the blood velocity was also increased, as may be seen in a typical result (Experiment I). In 3 other results (one of which is presented in Experiment II), the oxygen A-V difference remained unchanged within the error of the method. Th velocity of the blood flow of the general circulation, however, was increased approximately 1½ and 3½ times. In these cases the more rapid blood flow was associated with the lower peripheral resistance, as indicated by a fall in blood pressure. One patient (Experiment III) reacted poorly and lapsed into a comatose condition. At this stage the oxygen A-V difference became huge, while the velocity of the blood revealed only a small acceleration. The small O_2 reserve in the venous blood indicated an insufficient O_2 supply to the brain. It is suggested that this relative anoxemia produced the coma.[4]

Thus in every instance an increase of cerebral metabolism during fever was indicated. This increase was evidence by a larger oxygen A-V difference, a faster blood flow, or both. The effect of the heightened metabolism of the brain on cerebral syphilis warrants further investigation.

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[2] G. P. Robb and S. Weiss, *American Heart Journal*, 8: 1932–3, 650.

[3] H. S. Forbes and S. S. Cobb, *Brain*, 61: 221, 1938.

[4] Himwich, Bowman, Wortis and Fazekas, *Jour. Am. Med. Asn.*, 112: 1572, 1939.