ing as bacterial chemotherapy a book is necessarily at a disadvantage in that important developments are prone to follow closely upon its heels. The authors have attempted in some way to offset this disadvantage by adding an addendum to the book. However, for those interested it is desirable to have the pertinent facts in this important field collected together at frequent intervals. The authors are well suited to this task because of their experience both in the laboratory and in the clinic.

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SPECIAL ARTICLES

HYDROSOLS AND ELECTROLYTIC IONS

WHILE electrodialyzing some solutions of clay in water and in dilute acids and alkalies, a curious relation has appeared which throws light on the association of the electrolytic ions with certain of the hydrosols which may be present.

If a montmorillonite clay be brought to equilibrium with a dilute acid solution (say 1 per cent. hydrochloric) and then filtered and the solution electrodialyzed, it will be found that the silica is carried *equally* in both directions. Other ions present are usually found unequally in anode and cathode liquors, but the silica is strictly amphoteric, it either consists of equal numbers of anions and cations or is a carrier of equal numbers of such ions. After the effect was first noted, other experiments (25 in all) were made at different acid and alkali concentrations and on various clays including soil, all confirming the original findings or indicating necessary conditions.

The dialyzer used was an ordinary Mattson with the electrodes supplied replaced by others of sheet platinum. Cellophane membranes enclose the cell 1x10x15 cm. Electrode compartments are 3x10x15 cm. The current used was from a 116-volt line and held to below one ampere by a 100-watt lamp in series. Anode and cathode liquors were replaced by fresh distilled water four times at hourly intervals and each analyzed separately.

The clay solutions were prepared by digesting about 30 grams of 150 mesh (0.1mm) clay in two liters of acid solution for fifty hours at about 90° C. with frequent stirring. A few acid clays and acid-treated adsorbent bentonites require twice as long to bring to equilibrium. About 400 cc of the filtrate was evaporated to 150 cc for the dialysis. The total recoverable solids is from 1.5 to 5 grams per liter of solution according to acid concentration. At equilibrium, there is always free and adsorbed acid present as well as salts in solution.

Electrodialysis of a solution that has not come to equilibrium with a clay or soil shows an unequal partition of silica; an acid clay shows an excess of silica transported as cations, while a slightly alkaline soil gives a slight excess of silica as anions.

The first ions removed are H^+ and Cl^-. After the first hour the cations are largely the R_2O_3 bases. If an electrodialysis of an equilibrium solution is stopped at an early stage and the three solutions analyzed, the silica will be found in equal amounts in anode and cathode liquors as though run to completion. When a pure silica gel solution is electrodialyzed, the silica is equally divided. An alkaline solution of a neutral clay (Florida fuller's earth) gave four times as much anion silica as cation silica. The same solution neutralized with HCl just before dialysis showed an equal division (49 vs 51 per cent.) of silica. A water solution of an alkaline bentonite (Wyoming swelling, 1.2 grams per liter) dialyzed 64.6 + vs 33.5 − without and 48.1 vs 43.7 − with HCl added before dialysis. But the same solution with NaCl added before dialysis gave for + silica 95.5 vs − 4.5. When insufficient ions are present electrodialysis gives a precipitate of silica in the cell.

It seems hardly possible that silica in solution can consist of equal numbers of anions and cations. The alternative seems to be that other charged ions are adsorbed in equal numbers on the silica and supply the motive power in a potential gradient. Anions and cations are present in necessarily equal numbers, hence in equilibrium clay or soil solutions they must also adsorb in equal numbers on the silica hydrosol micellae with which the cations were previously associated. Certain added ions prevent equal adsorption, others do not.

These results will be given in more detail in a later paper. It would be of interest to know whether similar relations obtain in other fields, say in the relation of the silver halides to the gelatine in photographic emulsions, of ions to hydrosols in sugar solutions, in plant saps and the like.

P. G. NUTTING

U. S. GEOLOGICAL SURVEY

THE ASEXUAL LIFE CYCLE OF THE AVIAN MALARIA PARASITE, PLASMODIUM CIRCUMFLEXUM[1]

EVIDENCE has been accumulating for some time that the life-cycle of the malaria parasite in the vertebrate is less simple than has been thought and that the plasmodia are able to parasitize not only the erythrocytes

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