6. Osmotic Pressure of Colloids.

Using gut as a membrane determine the osmotic effect of a 25% solution of gum acacia. The experiment should be carried on till next period so as to distinguish the temporary (why?) effect of electrolytic impurities and the permanent (why?) effect of the colloid.

Compare osmotic expression of colloids v. crystalloids as regards (1) magnitude and (2) relation to permeability of membrane.

[The following section should be omitted until section B (Physiological) (1) to (13) has been completed.]

7. Anomalous osmosis — Positive and Negative.

McClendon: Chap. X. Small Jas: Textbook of Botany p.357; Bartell Journal Am. Chem. Soc. 1916 and 1920.

The following experiments illustrate the main types of disturbance of ordinary osmosis, based on the electrical theory.

(*a*) Set up an osmoscope with a membrane of pig's bladder or gut. To magnify the effect insert a narrow tube through a rubber cork into the wider tube.

On one side of the membrane place (M/2) citric or tartaric acid (Flusin 1908), on the other pure H_2O and allow to stand for two hours or longer.

(*b*) Repeat with a slightly hypotonic (e.g. equimolar) solution of sugar opposed to the acid. (The sugar partly neutralises the **normal** osmotic effect of the acid and being a non electrolyte has no "**abnormal**" osmotic effect of its own).

Set up similar experiments with

(*c*) Basic citrate (M/6O) and **hypertonic** sugar, (.3M)

(*d*) NaCl M/30 and **hypotonic** sugar M/20

(*e*) $AlCl_3$ M/160 and hypertonic sugar M/20

Record the direction of osmosis in each case and any divergence from the normal Does the disturbing factor assist or resist ordinary osmosis?

The fact that abnormal osmosis may be positive as well as negative eliminates relatively lower penetrability or diffiusibility of sugar as the cause.

The points to be studied are.

(1) Relative speed of kations and anions. (Kations quicker in (1) & (2) anions in (3) & (4).

(2) Resulting polarity of the membrane.
How orientated + and – ?

(3) Permeability (pore size) of the membrane. Is it semipermeable to the reagents employed? (Test chemically e.g. with $AgNO_3$ for chlorides, indicator for acid). Could a truly semipermeable membrane become polarized.

(4) Electrical charge of the membrane + in (1) & (4) (why?) – in (2) & (3).

According to electrical theory induced charge on adjoining H_2O particles causes them to be attracted to one or the other side of the polarized membrane.

Influence of H-ion concentration on direction of osmosis Illustrate by diagrams the above conditions as they exist in each experiment.

B. PHYSIOLOGICAL.

MATERIAL: Red and white onion, carrot, beet, haematocytes, frog's bladder, leg and skin.

1. Rates of Diffusion of various Substances into Protoplasm.

(a) Put onion epidermis with colourless sap, into weak neutral red, Congo red and other dies, and allow to lie for some time. Note different rates of diffusion of dye into protoplasm. Cf. A.1.

(b) Using the cells that have their cell sap coloured by neutral red, test the relative rates of penetration of NH_3, Na, and K-ions (solutions must not be stronger than N-800). Cf. A (4)

2. Semi-permeability and Permeability.

(a) The cells of tissues which contain colouring matter in solution being used, it may be found that such pigments do not diffuse through protoplasm in the normal condition but do so when sufficiently abnormal (Semi-permeability; permeability ; change of porosity).

(b) KNO_3, cane sugar, etc., may be used to plasmolyse cells when alive. Other substances there are which may not be used, e.g. ammonia, alcohol, etc., Test and explain the results.

3. Osmotic Pressure, tonicity.

Using a strong solution (1N KNO_3) note that the plasmatic membrane contracts; reducing the concentration sufficiently permits restitution. Determine the exact con-