Two vials are partly filled with warm gelatin-weak solution. After it has set congo red (large molecules) and eosin or methyl orange (smaller molecules) of approximately equal molar concentrations are poured in. (All gelatin experiments stand 24 hours or longer). Compare rates of diffusion of the two dyes.

(*b*) **The concentration of the diffusing substance** (gradient of diffusion). Compare diffusion rate of a stronger solution of methyl orange than in (1).

(*c*) **The physical condition of the medium.**

Compare same concentration of methyl orange as in (1) in stronger gelatin.

(*d*) **Physical or chemical interaction of diffusion substance and medium.**

(1) Strong methyl orange and strong methylene blue are poured into vials partly filled with gelatin.

(2) Partly fill three vials with gelatin tinted with indicator (eg. neutral red) and pour in equal strengths of different alkalis NH_4OH, NaOH, KOH (low concentration).

NOTE:—Gelatin combines somewhat with alkalis and the more readily the stronger the alkali.

(3) Mix starch paste with gelatin and allow iodine in KI to diffuse through it. Note absence of gradient in colour. Why?

2. Periodical Precipitation: Liesegang rings.

Gelatin containing potassium chromate in solution is poured on a glass plate. After setting, a drop of silver nitrate is placed thereon. Note the occurrence of the rings in question. Two separate sets of these rings may be noted.

This experiment may be profitably varied by introducing the gelatin into a vial, and after setting, silver nitrate poured in. Cork and keep for future observation. (Bechhold, p.260.)

3. Semi Permeable Membranes and Osmosis.

Three vials are $\frac{1}{4}$ filled with warm gelatin containing K_4 Fe Cy_6 dissolved. A layer of gelatin as cool as it will run is poured in up to $\frac{3}{4}$ vol. of tube.

After setting $CuSO_4$ of stronger osmotic concentration than the K_4Fe Cy_6 is added to one, of weaker concentration to another, of equal concentration to a third.

.84 gr. per litre $CaSO_4$ = .31 gr. p. litre K_4FcCY_6

From the position of the precipitation membranes (copper ferrocyanide) determine relative rate of diffusion of the two salts and of different concentrations of the same salt. Is the membrane permeable to the salts? to water?

Explain curvature of the membranes.

Understand permeability, impermeability, semipermeability, osmosis, osmotic pressure, toxicity, hyper–, iso–, and hypo-tonicity as exemplified in the above experiment.

4. Osmotic Pressure.

The direct measurement of osmotic pressure involves use of a semipermeable membrane. i.e. one which permits the diffusion of the solvent but not of the solute. This method can be used to demonstrate the phenomenon, but actual measurement is of extreme difficulty.

(*a*) Construct a simple osmoscope: Tie over the flanged end of a short glass tube a membrane. e.g. of gut or parchment paper. Partly fill this with a strong solution of sugar (molasses), to which a little copper sulphate has been added. Place in water to which a little potassium ferrocyanide has been added. Theoretically these added salts should be isotonic. Allow to stand for some time, recording the height of the column in the tube. Equalize initial pressures.

A duplicate of Pfeffer's osmometer will be shown.

(*b*) At the opposite edge of a wide drop of water on a glass slide, a small crystal of each of the above salts is placed. A copper ferrocyanide membrane is formed. Is this permeable to either of the salts? Vary this experiment by placing a crystal of one into a solution of the other salt in a test-tube, noting results. (Traube, 1867. Walden, 1892, see Bayliss).

(*c*) Repeat, substituting cobalt chloride and sodium silicate (a drop of the concentrated solution instead of a crystal, of course). (Leduc: Theorie physico-chemique de la vie, 1910.)

5. Artificial Cells.

Note that in contradistinction to the condition of para. 1. above if the stronger solution is enclosed in a membrane, the pressure must be exerted on its internal face in all directions. The practical difficulty of maintaining a semi-permeable membrane makes the demonstration on a large scale somewhat bothersome. Small crystals of cobalt chloride dropped into weak sodium silicate, however, afford precisely this condition on a small scale. This is duplicated in the mechanical aspect of a living cell, the plasmatic membrane of which is semipermeable to many substances. In fact, the cell may be used for determining, within certain limits, the concentration of solution of non-diffusible substances. (de Vries, cited above).