B. PHYSIOLOGICAL

MATERIAL: Onion epidermis, Tradescantia hairs, root hairs, blood plasma, etc.

1. H-ion Concentration of Living Cells and Biological Fluids.

(a) Approximately determine by allowing suitable material (colourless onion epidermis, Tradescantia hairs, root hairs) to absorb neutral red from weak solution. Estimate the colour of the cell sap.

Note any significant differences.

To obtain cell sap in quantity tissues are first frozen and then crushed and subjected to pressure.

(b) Determine the [H+] of blood plasma.

2. Biological "buffers".

Attempt to raise the [H+] of blood plasma by addition of acid. Compare [H+] of equivalent acid in pure H_2O. Explain in terms of buffer action. Biological significance?

PHASE RELATIONS OF EMULSOIDS AS INFLUENCED BY H-ION CONCENTRATION.

LITERATURE Macdougal: Hydration and Growth. Carnegie Institute Pub. .297, etc. Lloyd: Trans. Roy. Soc. Can., 1917; Mem. Torrey, Bot. Club, 1918.

A. PHYSICO - CHEMICAL

1. Swelling.

(a) Place gelatin strips of measured length in petri-dishes covered by solutions of graded H ion concentration from .2N acid (HNO_3) to .2N alkali (KOH) (acid. 2, .02, .002, H_2O. .002 .02, .2 alkali.)

Measure during two hours. Estimate [H+] by indicators. Illustrate graphically.

Compare the effect on [H+] of solution and on the swelling of the gelatin when certain concentrations of acid and alkali are mixed with neutral salt (KNO_3 of equivalent normality)

(b) Repeat with squares of agar, measuring increase in thickness. (Of course. weighing more accurately records amount of imbibition).

2. Gelation

(*a*) Compare the rate of setting of gelatin with various H-ion concentrations:

Add about 20 c.c. of strong melted gelatin to about 5 c.c. of N, .1N, .01N, HNO_3, H_2O, .01N, .1N, and N KOH in a vial. Carefully note the order of setting, recording times taken.

Remelt the gelatin and find the [H+] of the various vials.

Illustrate graphically relation of time of gelation to [H+] cf. swelling. Compare the [H0+] of similar concentrations of acid and alkali in H_2O (see "buffers" above).

Where is the region of maximum gelation — isoelectric point?

(*b*) Repeat with agar.

3. **Flocculation.** Note effect of acid and alkali on transparency of the emulsoids (See under B)

B. PHYSIOLOGICAL.

MATERIAL: Pollen, onion. The materials used in the above experiments are bio-colloids of the two main types that occur in cells. Similar phenomena as exhibited by **living** cells themselves are exemplified as follows:

1. **Protoplasmic. Swelling** and **resultant growth.** Allow pollen to germinate in a series of H ion concentrations ranging from say 10^{-3} to 10^{-9}, using acetic acid and ammonia. Compare rates of growth of pollen tubes.

2. **Liquefaction and Gelation.** Subject onion epidermis to similar concentrations of [H+] and study phase relations as expressed by Brownian movement of particles or protoplasmic circulation.

3. **Flocculation.** With reference to Note to A. (4) see Oertel; "General Pathology" p 182, re Fischer on "Glaucoma of the Eye."

SYNOPSIS V

DIFFUSION AND OSMOSIS

LITERATURE:—Ostwald: (1) Theoretical and Applied Colloid Chemistry, 43; (2) Handbook of Colloid Chemistry, 210; Bechhold: 52. "The diffusion of dissolved substances through membranes" Czapek, Chemical Phenomena in Life, p. 45. Bayliss: p: 110. Jost's Plant Physiology, p. 17. Principal classical researches; W. Pfeffer, Osmotische Untersuchungun. Researches in Osmosis: Studies in cell—mechanics. 1877; Devries, Plasmolytic Studies. 1885. McClendon, 291. Livingston, Role of diffusion and osmotic pressure in plants. 1903.

A. PHYSICO-CHEMICAL.

1. **Factors influencing rate of diffusion.** This depends on:

(*a*) **The size of the diffusing particles.**