The preparations are to be made in vials or test tubes; vigorous shaking is made use of to produce the dispersions.

Disperse paraffin oil in alcohol? Is the emulsion stable on standing?

Add a little powdered $BaSO_4$ or other insoluble substance and repeat the shaking.—Stability?

Study the distribution of the solid particles with regard to the two phases as seen on the surface of the test tube.

Examine a portion microscopically. Explain how the solid powders promote stability of the emulsion.

(d) **Relation of phases in an emulsion complex; effect of change in surface tension; haptogen membranes.**

The emulsion obtained is to be fractionated for the purpose of getting portions for the separate tests to be made with pigments.

1. Disperse a small portion of paraffin oil in water. Is this stable?
2. Add a little gum arabic solution; note stabilizing effect.
3. Add successive small volumes of oil, and produce a dispersion of maximum viscosity, noting the increase in viscosity with the increase in the amount of the internal phase, also with degree of dispersion.
4. To a portion add a very little eosin, and note the fate of the pigment. Examine microscopically, l.p.
5. To a similar portion add a very little Sudan III, and proceed as under (3).
6. To the original emulsion add again successive volumes of oil and note that the emulsion finally breaks, the viscosity being lowered. After passing this point repeat (4) and (5).
7. Study microscopically, carefully comparing the four preparations, noting the distribution of pigments and the occurrence of compound fluid suspensoids, and that these are "protected" by "haptogen" membranes. Get clear conceptions of the various aspects of the complexes in the preparations.
8. Note two fold role of the gum acacia—in lowering surface tension and in forming these haptogen membranes.

3. Electric Charge

(a) The electrical charge of colloidal substances (ex. carbon susp.) will be demonstrated by cataphoresis.

(b) Flocculating effect of kations and anions of different valencies.

Make solutions of:

K_2SO_4 .1 molar as to K°, $CaSO_4$ .01 molar as to Ca° °, La_2 $(SO_4)_3$ .001 molar as to La° ° °. (Bayliss Intro. p. 178). To each add equal vols. of indian ink.

Compare the effect of polyvalent anions. Cf. also with positively charged colloid e.g. ferric hydroxide.

(c) A filtered 5% solution of albumin is (i) acidified with acetic acid. (ii) rendered alkaline with NaOH.

Precipitating effect of + & − colloids?

Amphoteric electrolytes. See also under Hydrogen Ion Concentration.

(d) Do emulsoids (gelatin) behave like suspensoids as regards precip. by traces of electrolytes.

Relation of phases as det. by H-ion concentration, see later—Syn. IV.

B. APPLICATIONS TO PROTOPLASM

MATERIAL: Onion epidermis

1. **Colloidal Structure and Viscosity of Protoplasm.**

(a) In cells of onion epidermis which has lain for some time in weak neutral red, study under h.p. and oil immersion lenses the protoplasm and included particles with special reference to streaming and Brownian movement. Study the effect of raising temperature and of various concentrations of ether, iodine, etc.

Consider: 1. The nature of protoplasm (i.e. its structure) as a diphasic (resp. polyphasic) system; cf. structure of fixed protoplasm as seen in prepared slide with that of an emulsion containing solid particles as in A. (c); its viscosity (on the viscosity of protoplasm estimated experimentally see Wm. Seifriz, Viscosity values of protoplasm as determined by microdissection, "23 times that of water". (Botan. Gazette 70, 360, Nov. 1920. Bot. Abs. 3: 1740.)

2. The diffusibility of substances through protoplasm. Are these fat-soluble or water-soluble? The role of lipoids in protoplasm. (Hansteen-Cranner E.S.R. 44: 821.)

3. The role of haptogen membranes in forming external limiting membranes.

4. The behaviour of cell colloids analagous to that of gum acacia.

(b) Review the experiments with Spirogyra in Syn. II, B from the point of view of changes in viscosity brought about by the external factors employed.