SYNOPSIS I.

REVIEW OF BIOLOGICAL MATERIAL

READING: Bayliss, "Principles of General Physiology" pp 1-6. Thompson "Growth and Form," pp. 156-162.

The purpose of this exercise is in part to review one's knowledge of the cell, and in part to contemplate it as a complex of energy expressions. Viewing the living substance in this light, it is apparent that every detail of form and behaviour is of significance to the general physiologist.

"The microscopic structure which it seems to show is that of a more or less viscous colloid, or rather mixture of colloids, and nothing more." (Thompson, "Growth and Form," page 160.)

"……it appears……as a clear, colourless, jelly-like stuff, not showing structure, but nevertheless……" (Bayliss, "Principles of General Physiology," page 2.)

The point of view is indicated by the preceding quotations. It is assumed that the student is acquainted with the formal cell terminology. In reviewing the above organisms or parts of organisms, one should make accurate delineations of the cells, including all the contents, having particular respect to details of form and interrelations of parts, constantly asking why a particular form or position is assumed.

MATERIALS: Spirogyra, Vaucheria, Elodea, cells of onion bulb epidermis, pollen grains, etc.

One's attention is directed to the form of the nucleus, of protoplasmic threads, of chloroplasts, and on what it appears to depend; to the positional relations of various parts, viz. of the points of insertion of protoplasmic threads, of the nucleus, of the cytoplasm, of the chloroplasts, of the granules and of the vacuoles.

DIRECTIONS: Make sketches of the above showing the normal topography, indicating cytoplasm, nucleus, plastids, wall, vacuoles, having due regard for the relative dimensions. Pollen grains may be crushed also, when some idea of the character of the protoplasm may be gained.

Microscopic appearance of protoplasm. Consider the results of the above observations on protoplasm. Take a thread of Vaucheria, a syncytial form, and manage to squeeze out some protoplasm by cutting off the end of a filament in a very small drop of water, followed by pressure of the cover-glasss. Drops of protoplasm with inclusions (plastids) may be found. Note particularly the colourless and structureless appearance of the protoplasm.

SYNOPSIS II.

SURFACE TENSION

PHENOMENA OF FORM AND MOVEMENT.

READING: Bayliss pp 48-51. Pfeffer, "Physiology of Plants" p. 275 et seq. Jost, "Plant Physiology" pp. 537-540. Thompson, "Growth and Form", Ch. V.

The preceding observations on the form of protoplasm and of various included parts, suggest the probable significance of surface tension as a factor involved in determining form. The following experiments have been chosen for the purpose of directing attention to the physical expressions of surface tension offering analogies to protoplasmic behaviours, and to such protoplasmic behaviours themselves.

Many of the experiments are characterised by extreme simplicity, for which reason the student can underestimate their importance. It should be realised that it has been through the contemplation of these and similar experiments that the biologist has reached such understanding of the living stuff as we have. In general experiments have been chosen which have historical significance, and in these cases the authority has been cited, either the original citation being given, or one to which the student has easier access.

Success in achieving results from these and following experiments will depend upon painstaking observation, deliberation and contemplation. To quote Gilbert, of Gilbert and Sullivan: "Quiet, calm deliberation disentangles every knot".

A PHYSICAL BEHAVIOURS.

1. **Surface Film.** Float a needle on clean water, add a trace of soap.

2. **Minimal area.** A loop of copper wire, with a smaller silken loop suspended to the limb of the copper loop by three loose threads. A soap film is supported in the wire loop and variously broken (van der Mensbrugghe, 1866. See Bayliss, 48).

3. **Change of form and movement due to disturbance of surface tension equilibrium by factors external or internal.**

(a) To a drop (shape ? and why ?) of mercury lying in weak nitric acid a crystal of potassium dichromate is presented. Note behaviour of mercuric oxide toward the surface of the mercury. (Bernstein, 1900, see Pfeffer, III. 278). Also study surface currents when H_20 mixed with carbon is presented with drops of alcohol on bottom of petri dish.