cells ;" Tait and Gunn : "The blood of Astacus fluviatilis"—Quart. Journ. of Exp. Physiol. XII., I.). Schaeffer A.A. (1920), "Amoeboid Movement."

ADSORPTION PHENOMENA.

For definitions and discussions see Bayliss, p. 54–;
Bechhold, p. 25–; McClendon, p. 62–; (erratum p. 64, line 18, for " increase " read " decrease ") ; MacLeod, p. 65–; Ostwald; Theoretical and Applied Colloidal Chemistry, p. 116–.

A **PHYSICAL BEHAVIOURS:**

1. **Surface concentration:** Take a weak solution of methylene blue (deep sky-blue) and add a very little saponin. Vigorously shake and separate foam by decanting. Shake up the decanted fluid similarly and again decant. Amount of foam on second shaking ? Add a drop of alcohol to foam in vessel No. 1 to dispel it (why does this happen ?) and note colour of fluid. Amount of foam on shaking in No. 2 and in No. 3, and why ? Effect of saponin on surface tension of water ?

Shake up a solution of albumin (egg-white). Remove foam and try to redissolve in water.

2. **Membranes resulting: Concentration membranes .**Using a piece of glass tubing as a blowpipe, blow bubbles of soap, saponin and of albumin. Permit the bubbles to contract (expel the air by surface tension) and note whether the bubble maintains its spherical shape. Observe carefully the surface by reflected light.

3. **Electrical adsorption.** (a) Dip pieces of filter paper in equally coloured solutions of Methylene blue (+ charge) and Indigo Carmine (− charge) or of Fuchsin (+) and Eosin (−) and wash.

Compare the loosening effect of saponin or alcohol on adsorbed dye as compared with pure H_2O. Explain.

(*b*) Carefully place a drop of each of the same and other stains on filter paper. Observe the different behaviours of the dyes. Add successive drops in the centre of the positions of the original drops, and note results.

(*c*) Allow a drop each of methylene blue and of, say, eosin, to evaporate from a glass surface, and attempt to redissolve in running water.

(*d*) **Selective adsorption of Ions.** If one ion is adsorbed the other remains in solutions. On filter paper place drops of acidified methyl orange, of alkaline Neutral Red, and of neutral Methyl Red.

Note varied adsorption of H and OH ions by the filter paper. Isoelectric point of cellulose ?

(*e*) **Adsorbed ions may reverse electrical charge.**

Place drops of Eosin and Methylene blue (in distilled water) on filter paper.
Repeat after adding a little NaCl to the dyes.
" " " " acid also.
Demonstrate filtering with charcoal, sand, etc.

B **BEHAVIOURS IN PROTOPLASM.**

MATERIALS: Vaucheria, onion, spirogyra, (paramoecium), frog's muscle, banana

1. **Concentration membranes.**

(*a*) The broken surface of protoplasm is supplanted by a membrane. Cut a filament of **Vaucheria** and record evidences of formation of a new membrane. Also evidence for membrane existing on uninjured protoplasm.

(*b*) Plasmolyse onion cells strongly and suddenly add water. In many cells the liquid inner protoplasm will rupture a solid external layer.

2. **Toxicity.**

The relative toxicity of the members of the alcohol series (methyl alcohol appearing to be an exception: difficulty oxydizable or other reason) follows, according to Kamm, the rule of Traube based on surface tension experiments, namely, $1:3:3^2:3^3$, etc., taking the physiological effect of ethyl alcohol as unity.

Example: Toxicity of ethyl alcohol for Paramecium is 4.5%. What is, theoretically, the toxicity of e.g. n−octyl alcohol ? Ans.—1 x 3 x 3 x 3 x 3 x 3 x 3 or 729.

Formula $\frac{4.5\% \times 2.8 \text{ (to convert moles to grams)}}{729} = 0.20\%$.

The observed value, according to Kamm, was 0.03%. (Kamm. Oliver, The prediction of the physiological action of alcohols. SCIENCE.N.S. 54:55. 15 July, 1921, and in the current issues of Jour. of Pharmacol).

Experiments: Test pure methyl alcohol relative to ethyl alcohol, and to other alcohols so far as provided. Also acetone. Spirogyra or Paramecium, or other suitable material.

3. **Immunity.** For its relation to surface tension phenomena e.g. phagocytosis, agglutination and adsorption, see Oertel, " General Pathology ".