ulated" animal; this giving rise to inequalities in tension within the total organism and resulting in an extrusion of protoplasm at the point of stimulation and a movement in the direction of its source.

Since proteins constitute the essential hydrophilic colloid which makes up the living cell and since we are familiar with a series of chemically well-defined substances which make such proteins swell, the effects of these substances in evoking protoplasmic movement were studied. *Those materials which are known to be hydrators of proteins will, when properly employed, lead to the extrusion of pseudopodia by amoeba and a movement of the organism in the direction of the "stimulus."*

I found that a stock amoeba, grown in an aquarium, would come to rest in approximately spherical form after two washings and a rest period of thirty minutes in a .3 per cent. sodium chloride solution. Transfer was made by means of a capillary pipette in order that as little as possible of the aquarium water might be transferred.

In each of the following experiments a single amoeba was placed in a hollow-ground slide carrying 0.25 cc of the salt solution. The exact position of the amoeba was followed by the insertion of a double-ruled glass disk in the eyepiece of the microscope. This ruling yielded a square, approximately the size of an amoeba, with eight lines radiating from it, each pair of which bounded a lane along which the chemical solutions employed might be introduced and the swelling observed. The solutions were introduced from a capillary pipette fitted with a rubber bulb.

When .005 cc of 5/N HCl is introduced close to an amoeba which has reached a state of inactivity in a sodium chloride solution, the animal responds by sending out a process toward the acid. The whole amoeba may be observed to move toward the acid. After such initial and directional movement and after the acid has had time to diffuse, pseudopodia may be sent out in haphazard fashion over larger areas of the stimulated surface. If, after such treatment, the amoeba is returned to its normal habitat, it moves about normally.

Lactic, acetic and sulphuric acids act similarly when employed in the same amount and strength.

While all acids increase the hydration capacity of protein colloids, they show a large quantitative difference and this difference does not follow their dissociation in aqueous solution or the concentration of the hydrogen ions they yield, but is specific—hydrochloric, lactic, acetic and sulphuric acids, for instance, are effective in the order named when compared. *The same is true of their effects in eliciting amoeboid motion.*

In the same amount hydrochloric acid is effective at a concentration of N/4, lactic acid at N/2, acetic acid at 1/N. Sulphuric acid is not effective until a concentration of 5/N is reached. In the case of each acid the speed and amount of reaction of the amoeba is increased as the concentration of the acid is increased.

Urea, the amines and the alkalies are among the substances which act as hydrators of proteins. *These all have the property of inducing amoeboid movement.*

A crystal of urea (weight - 0.001 gm.) acts in the same manner as the acids.

Paraphenylenediamine proved to be the most satisfactory of all the agents which I studied. This substance dissolves so slowly that the amoeba may be observed to migrate in the direction of the crystal. The movement is slow and flowing in character and differs in no respect from "normal" amoeboid movement. The amount used was the same as in the case of urea. If, after such treatment, the animal is returned to its normal habitat, it moves in a "normal" manner.

When 5/N NaOH is used in the same manner as the acids, the amoeba responds in the same way.

All inorganic salts antagonize—even without chemical neutralization—the swelling effects of acids upon protein colloids. They do this in a definite order, univalent radicals being less effective than divalent at the same molar concentration, and these than trivalent. *The same is true of amoeboid movement.*

In this group of experiments the amoeba was permitted to come to rest in .3 per cent. sodium chloride solution and then placed in .25 cc of a solution of the salt to be tested; .005 cc of 5/N HCl was used as a "stimulus" in each case. Ferric chloride produces complete inhibition of movement at a concentration of .05/M; calcium chloride and magnesium chloride between .1/M and .2/M; while sodium chloride does not produce this effect until a concentration of .6/M is reached. For any given salt the response of the amoeba to the "stimulus" decreases as the concentration of the salt solution increases.

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