of uniform weight of 300 gr. which developed beriberi on white rice. The dose of the administered solutions was gradually worked down to .1 c.c. which was found to be the minimum dose in both cases. The result therefore was that the radium emanation has no destroying action on beriberi-vitamine.

In a similar way it has been ascertained that radium emanation possesses no action on the vitamine which stimulates growth in young rats so that by the above method the differentiation of the two vitamines has not been accomplished. The method used was the same as that described by Funk and Macallum.[1] Here also the radium emanation was found to have as little action as on the beriberi-vitamine.

Finally the action of radium emanation was tested on Rous's spindle cell chicken sarcoma. An extract of the tumor was prepared under aseptic precautions, which was filtered through filter paper and divided into two portions. In one of the portions emanation tubes with a measured amount of emanation were directly inserted and left for forty-eight hours, the control liquid being kept the same length of time. Both solutions were then injected into the pectoral muscle of a number of small chickens. In both cases tumors have appeared after a delay of 3–5 weeks which shows that radium emanation has hardly any action at all on the agent of the chicken sarcoma even when used in doses exceeding those applied in cancer therapy.

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The mechanism of the diffusion of electrolytes through the membranes of living cells.

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When eggs of *Fundulus* are transferred from sea water directly into a solution of a potassium salt a number of embryos will be poisoned during the first hours so that their hearts stop beating. When the eggs are washed for twenty-four hours in H_2O (or any solution of a non-electrolyte) before being put into the same

[1] *J. of Biol. Ch.*, 27, 51, 1916.

solution of potassium salt they have acquired a remarkable immunity against potassium salts. When eggs are put directly from sea water into an $m/8$ KCl solution in one and one-half hours the heart beat stops in two thirds of the eggs; the same effect requires in eggs previously washed for twenty-four hours in H_2O four days, *i. e.*, an $m/8$ KCl solution poisons the embryos of unwashed eggs sixty times as rapidly as the washed eggs.

It can be shown that this difference between the washed and unwashed eggs is due to the fact that the unwashed eggs have some of the salts of the sea water at their surface. If we put washed eggs into $m/8$ KCl solutions made up in H_2O and different concentrations of sea water or NaCl + $CaCl_2$ or NaCl or any other Na salt, the eggs are poisoned the more rapidly the higher the concentration of the sea water or the sodium salt, up to a concentration of about $m/4$. If a slightly higher concentration, *e. g.*, $m/1$, is used, the opposite result is observed; namely, a retardation of the rate of diffusion of KCl into the egg and hence a protection of the eggs. This is the antagonistic salt action which has hitherto exclusively occupied the attention of biologists.

Experiments, which lack of space forbids to enumerate, show that the difference in the rate of poisoning of the embryos mentioned, is due to a difference in the rate of the diffusion of the potassium salts through the membrane. It follows then that for the diffusion of potassium salts through the membrane of the egg of *Fundulus*, *aside from the osmotic pressure of the solution a second factor is required, which we will call the general salt effect, and which consists in a reaction between the electrolyte and a certain constituent of the membrane* (possibly the proteins) *whereby the membrane becomes diffusible for the potassium salt.* If the potassium salt is alone in solution it cannot diffuse into the egg until it has produced the salt effect upon the membrane. This requires considerable time if the concentration of the KCl solution is low and this explains why it takes so much more time for the KCl solution to poison *washed* eggs than eggs transferred directly from sea water into the KCl solution.

A further proof for the correctness of this view is found in the fact that if eggs are poisoned in a potassium salt they cannot recover when put into a solution of a non-electrolyte, while they

will recover in the solution of certain electrolytes. The recovery depends upon the possibility of the diffusion of potassium salts out of the egg and not of the diffusion of the outside solution into the egg, since very toxic solutions of electrolytes, *e. g.*, NH_4NO_3 or $(NH_4)_3$ citrate, may be as efficient in bringing about the recovery of the egg as comparatively harmless or beneficial salts, like NaCl or NaCl + $CaCl_2$ or sea water. The relative efficiency of various salts for the production of the "general salt effect" depends to a large extent on the nature and valency of the anion and is for Cl : SO_4 : citrate = 1 : 4 : 16, *i. e.*, it follows Hardy's valency rule for the precipitation of proteins. This suggests that we may be dealing in this case with an action on some protein. The same valency rule holds not only for the acceleration of the rate of the diffusion of potassium salts but also for the opposite effect; namely, the antagonistic salt action.

Somewhat similar results were obtained for the diffusion of acid into the egg and these experiments seem to indicate that for the diffusion of these two groups of electrolytes, potassium salts and acids, in addition to the osmotic pressure of the substance a second effect is required which we call the general salt effect and which consists in the modification of a certain constituent of the membrane (possibly a protein) by the salt.

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The registration of heart sounds from the exposed heart and large vessels. A demonstration.

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For a number of reasons it was questionable whether the heart sounds recorded from the resonant thoracic wall are composed of the same vibrations as those actually arising within the heart. To assist in answering this question a method of registering the sounds from different spots on the exposed heart and large vessels was devised. The apparatus consists of a sound receptor