The importance of food intake records for individual animals has been emphasized.

Evidence is cited to show that the rat is limited in its ability to store vitamin B.

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The influence of the liver on the chemical regulation of the heart.

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The liver was the first tissue to which the function of internal secretion was ascribed by the genius of Claude Bernard. The liver is further the place of the most manifold and intense chemical processes in the animal body and no single cellular unit is in possession of so many enzymes as the liver cell. Yet as to internal secretion of the liver our knowledge is very scanty and modern text-books of endocrinology make little mention of the liver in this connection.

Dr. Takahashi and myself have made a series of experiments on the question as to whether the liver contributes towards the chemical regulation of the heart-beat. We have employed methods which we have been using for related questions since the year 1917 in studying the possible chemical basis of the action of antagonistic nerves, such as those regulating the beat of the heart. We used frog's heart as this is very sensitive to slight changes in chemical conditions and allows easy investigation under controlled conditions without any other influences hampering the results. Either a normal Ringer's solution, or Ringer's solution mixed with blood, was perfused from a small collecting vessel by way of the vena cava interior through the heart and returned from the aorta to the collecting vessel. We used this method in order to be able to work with small quantities of the fluid and to collect any substances which may be formed during the course of the experiment. The beat of the heart is recorded by aid of a suspension lever. Both vagi are laid

on electrodes and stimulated from a graduated Kronecker induction coil to ascertain the excitability of the vagi. A second frog is taken and the heart perfused in the same way with the only difference that the fluid coming from the collecting vessel is made to pass the liver first, from whence it enters the heart. The fluid which has repeatedly passed liver and heart during a period of half an hour is then transferred to the other heart. The effects of this fluid which has passed the liver on the heart are very marked. The heart beats become augmented in size and in frequency and in harmony with these facts the excitability of the vagi is lowered. In certain especially successful experiments, where the conditions were favored by the possibility of stimulating with very weak stimuli, during the passage of the fluid having previously passed the liver, a stimulation of the vagi which before had caused inhibition now evokes acceleration of the heart. The action was very much like that of a slight dose of atropin which by paralyzing the inhibitory fibres of the frog's vagi, allows the sympathetic augmentary fibres to prevail. In certain, not very frequent cases, there may occur a reversed effect, *i. e.*, an increase of vagus excitability probably due to functional adaptation, the importance of which for the understanding of hormonal activity I tried to insist upon in my Harvey Lecture, delivered February 24, 1923. But the main effect is a preponderance of the sympathetic side of the heart's activity.

Various conditions must be fulfilled to bring out the effects here preliminarily reported. Using the frog's heart, it is better to employ a mixture of blood and Ringer's solution. The perfused fluid should be continuously aerated. To exclude a difference of the two fluids compared, they are brought to the same content of sugar.

A series of experiments was also performed on the tortoise heart. Two animals were used and the methods were essentially the same as in the former experiments. Conditions of the vagi are somewhat different from those in the frog. In perfusing the liver it is better to abstain from using defibrinated blood, as the blood which has passed the tortoise liver will always coagulate, evidently by the rapid formation of fibrinogen in the tortoise liver. The results in these experiments are the same as in the former series. The fluid which has passed the liver con-

tains something which has an augmentor action on the heart and decreases the inhibitory action of the vagi.

In the experiments of both series the primary conditions were restored by perfusing a fluid which had not before passed the liver. These experiments, of which a more detailed report will appear in another place, seem to show that the liver contributes towards the chemical regulation of the heart-beat, acting on the neuro-muscular mechanisms of the heart. One may also call it a hormonal control of the heart by the liver, and if one accepts this mode of expressing the facts, the experiments recorded demonstrate an internal secretion of the liver. For the moment I prefer to speak of chemical regulation, the nature of which we are trying to study by further experiments.

I should not like to close this preliminary communication without reminding of the interesting and highly suggestive experiments of Cannon, who found in the mammal that acceleration of the heart, evoked by reflex stimulation, could persist in a certain degree even after extirpation of the adrenal glands —as was also found by Stewart—and was due according to his experiments to the influence of the liver.