nancy of the tumor is influenced through an action on the animal organism. This conception is supported by the fact that, as reported elsewhere,[3] definite changes in the weight relationships of nearly all the organs of the body occurred in normal animals coincident with the changes in malignancy, and that the correlation was especially close in the case of organs that have been shown to be capable of exerting a profound influence on the malignancy of the tumor.

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### Seasonal changes in organ weights and their relation to meteorological conditions.

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It is well known that many of the endocrine glands of normal animals undergo rhythmic changes in weight per unit of body weight which conform, in general, with seasonal conditions. Still, the cause of these changes is not clearly understood nor is it generally known that other organs and tissues such as the heart, the liver, the kidneys, the spleen, the thymus, the lymphoid tissues, and even the brain, undergo changes of a similar character.

In November, 1921, we began a series of investigations which included among other things a study of the ratio of the weights of various organs and tissues to the body weight of normal rabbits and the limits of variation that might be encountered, with especial reference to the causes of such variations. The factors studied included age, breed, length of caging, time of killing (with reference to the regular system of feeding), and meteorological conditions. All of the animals used were males, and an

[3] Brown, W. H., Pearce, L., and Van Allen, C. M., Seasonal changes in organ weights and their relation to meteorological conditions, PROC. SOC. EXP. BIOL. AND MED., 1924, xxi, 371.

effort was made to minimize the influence of dietary factors by maintaining a uniform system of feeding and a uniform diet consisting of hay, oats, and cabbage, which is the regular diet given all rabbits in these laboratories.

The plan followed was to kill and examine two groups of rabbits each month selected from stocks that were being used for experimental work. All animals were well nourished and free from any external evidence of disease. During the first few months the groups were small and intentionally of a mixed character, but beginning with June, 1922, the monthly groups consisted of from ten to twenty rabbits.

The animals were killed prior to the daily feeding; they were anesthetized with ether and bled from the inferior vena cava while the heart was still beating. The organs were removed, freed of all adventitious material, and weighed on suitable balances. The weights were then reduced to terms per unit of net body weight which was determined by subtracting the weight of the gastro-intestinal mass from the live weight of the animal with an additional allowance made for excess urine in the bladder.

In this report we wish to refer briefly to one feature of the results obtained, namely, the seasonal occurrence of rhythmic changes in organ weights and the relation of the changes in certain organs to the monthly hours of sunshine as recorded at the Central Park Observatory in New York City. Other phases of the work will be reported later.

Without attempting to give a detailed statement of the results obtained, it may be said that all the organs examined were found to undergo rhythmic changes in weight per unit of net body weight which conformed, in general, to the progression of the seasons. In the case of organs such as the heart, the kidneys, and the liver, the transition from one condition to another occurred relatively slowly, and the maximum variation in any direction was distinctly less than that noted in the case of a number of the endocrine glands and the lymphoid tissues. The heart and the kidneys showed a variation in weight amounting to approximately 20 per cent while that of the liver reached upwards of 40 per cent.

The change in the weights of the endocrine glands, the thymus, the spleen, and the lymphnodes was much more pronounced and in some cases amounted to as much as 50 to 100 per cent.

On attempting to correlate this series of seasonal variations in organ weights with meteorological conditions, it was found that the majority of them corresponded in time and direction with prevailing conditions of sunlight. In general, the periods of maximum and minimum weights coincided with high or low levels of daily sunlight while the change in direction and the transition from one condition to the other corresponded with the change in sunlight from winter to summer or from summer to winter. What is more significant, however, is the fact that the actual time and progress of the change followed the curve of the actual hours of sunshine rather than the theoretical curve or the uniform progression of the seasons. This was more noticeable in the case of some organs than of others. In fact, it appeared that the weight curves of some organs conformed more closely to the curve of temperature or to humidity than to the curve of sunshine, and that the degree of correlation in any case was subject to the influence of other factors.

The most important deductions to be drawn from this series of observations are: First, that no fixed relationships exist between the various organs and tissues of the body—that mass relationships and probably functional activities are subject to continuous change in response to certain external influences such as are represented by climate or meteorological conditions; second, that these changes tend to pursue a rhythmic course in harmony with the progression of the seasons, but that they are retarded or accelerated or otherwise affected in accordance with prevailing meteorological conditions, and that there is a particularly close relationship between the state of the animal organism at any given time or the occurrence of a change in the relations that exist, on the one hand, and the prevailing condition of sunlight, on the other. Finally, in considering the influence of factors of this kind, there are two things to be taken into account, namely, the normal or prevailing level of activity and the factor of change.