It has been found (Table I) that normal tissues of the same type but taken from separate animals, such as myocardium from different hearts, have a relatively high "total B vitamin uniformity" (70 per cent. or more), while normal tissues which differ from each other in structure and function have a relatively low degree (less than 30 per cent.) of "total B vitamin uniformity" when compared with each other.

TABLE I

VITAMIN UNIFORMITY IN NORMAL AND CANCER TISSUES

Tissues	"Total B Vitamin Uniformity" in per cent.
Human Tissues	
8 diverse normal tissues	27
Myocardium from three separate hearts*	71
8 diverse cancer tissues	66
Normal mammary, ovarian and renal tissue	11
Mammary, ovarian and renal carcinoma	60
Rat Tissues	
8 diverse normal tissues	30
Myocardium from three separate hearts*	75
5 diverse cancer tissues	63
2 hepatomas	78
2 hepatomas with corresponding adjacent liver tissues	22
Mouse Tissues	
Myocardium from three separate hearts*	76
12 diverse cancer tissues	58
Human, Rat and Mouse Tissues	
Myocardium from three human, three rat and three mouse hearts	61.2
8 human, 5 rat and 9 mouse cancer tissues of diverse origins and sites	58.8

* Individual tissues other than the heart from different specimens (in human, rat and mouse) also show high "total B vitamin uniformity" but are not included in this table.

Examination of the tumor material in this manner disclosed that malignant tumors which differed from each other in tissue of origin, manner of induction and host species tended to have a relatively high "total B vitamin uniformity" when compared with each other.

Since in our observations on normal tissues a relatively high degree of "total B vitamin uniformity" has been found to be associated only with homogeneous and never with heterogeneous groups of tissues, it is concluded that malignant neoplasms of various types and from various animals tend to have similar cellular metabolism, forming in effect a common tissue type.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE DETERMINATION OF BLOOD VOLUME WITH RED BLOOD CELLS CONTAINING RADIOACTIVE PHOSPHORUS (P^{32})[1]

THE red cell, rather than the plasma component of the blood, has several advantages in determining blood volume. First of all, the fluid portion of the blood, because of its physiological connection with tissue, lymph and other fluid spaces, is not so anatomically delimited as that containing red cells. Secondly, changes in capillary permeability affect the plasma much more frequently and markedly than the red cells. Third, the dyes used to measure plasma volume, because of diffusion and adsorption, may themselves behave differently from the plasma they are supposed to measure.

Total red cell volume has been measured by the carbon monoxide method, which, however, has not achieved acceptance for a variety of reasons. More recently, blood volume methods have been described using red cells containing radioactive iron[2] and radioactive phosphorus.[3] Though radioactive iron has a long half-life and remains in the red cells for long periods it has a serious practical disadvantage of emitting such soft radiation that direct measure of the radioactivity of the blood is technically difficult and requires more or less complicated chemical manipulations. On the other hand, radioactive phosphorus, though its half-life is but 14 days, emits energetic beta particles which enables red cells containing it to be measured more easily. Nevertheless, in the phosphorus method described by Hahn and Hevesy[3] chemical extraction of the red cells was necessary; moreover, a large amount of blood (50 cc) was used for the extraction.

In the technic to be described herein, but two cc of blood were used and they were measured directly in the Geiger counter without any chemical manipulation whatever. A donor dog was prepared by the subcutaneous injection of sodium phosphate containing radioactive phosphorus. The dose was 0.4 millicuries (P^{32}) per day for 10 days. After several days the red cells became so intensely radioactive that the blood could be diluted 100 times and yet give a sufficiently high count for accurate measurement. Washing the cells in saline several times and suspending in saline for 24 hours resulted in very little loss of activity. For the determination of blood volume 10 cc or more of the donor dog's blood was heparinized, centrifuged and the plasma (which also contains radioactive phosphorus) removed. The cells were resuspended in

[1] Aided by a grant from the Commonwealth Fund.

[2] P. F. Hahn, J. F. Ross, W. F. Bale, W. M. Balfour and G. H. Whipple, *Jour. Exp. Med.*, 75: 221, 1942.

[3] L. Hahn and G. Hevesy, *Acta Physiol. Scand.*, 1: 3, 1940.

saline and a carefully measured amount (1 cc/Kg) injected into the dog whose blood volume is to be measured. After allowing a variable time for mixing, a sample was removed, its radioactivity measured directly and compared with that of the sample injected. The blood volume was a simple matter of division. To determine red cell and plasma volume, the hematocrit provided the necessary relationship for the calculation.

We determined the radioactivity of the recipient dog's blood at various intervals after the injection in order to determine whether there was a curve of disappearance as there is with the dye method; we found no loss of activity for several hours which was more than long enough for thorough mixing. However, a slight but increasing loss of P_{32} from the red cells was observed thereafter, confirming previous observations of Hahn and Hevesy.[3,4] In this respect radioactive phosphorus presents a disadvantage over radioactive iron which, as already mentioned, remains for a long time within the red cell. On the other hand, for ease and simplicity, the method here described enables a determination to be made on one single sample of blood from the dog to be tested and but two direct determinations of radioactivity on the Geiger counter. Incompatibility of donor and recipient, though rare, will make the test valueless because of hemolysis. Our results confirm those of Hahn *et al.*,[2] in that the blood volume as determined in the above-described method is lower than that obtained by simultaneous determinations with the blue dye (T–1284). Additional details will be described later.

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FREEZING MYRIAPODS FOR PHOTOGRAPHING

PHOTOGRAPHING small myriapods, such as pauropods 1.5 mm in length, presents many difficulties. Distortion especially is pronounced when they are inactivated or killed. The application of anesthetics such as ether, chloroform, chloretone, etc., to immobilize them was not found satisfactory because of ensuing contraction and distortion. Specimens preserved in alcohol or formaldehyde were likewise found to be misshapen.

Slow killing in a sealed moistened cell chamber mounted on a glass slide was tried. By applying heat from a 60-watt bulb at a distance of 6 to 8 inches, the specimens became immobile in a few minutes. This procedure partially solved the problem of getting the desired relaxation but was discontinued when found to be rather erratic.

Finally, quick freezing was tried and found successful. A small glass circular cell was placed on an ordinary glass slide and the bottom covered with thick, black absorbent paper or a mixture of 3 parts plaster of Paris and 1 part powdered animal charcoal. Moisture was added, live specimens placed within, and the cell sealed with a cover slip. The specimens were then exposed to a temperature of $-12°$ C for about 25 minutes which killed them and at the same time preserved a nearly normal appearance.

A fixed focus camera used with a compound microscope was prepared ahead of time. For our set-up it was found satisfactory to use a Bausch and Lomb surface illuminator. When the specimens were ready they were taken from the freezing chamber and immediately photographed. If desirable the cover slip may be removed during exposure and replaced immediately after to prevent drying. Thus, the same specimen may be used more than once. With the light source at our disposal it was found best to keep exposure time ½ second or less, since a longer period tended to curl and dry the specimens. This freezing method should be equally applicable in photographing other small organisms.

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[3] L. Hahn and G. Hevesy, *Nature*, 144: 72, 1939.