blue, fails to influence certain isolated components of the clotting mechanism, and acts principally on the first phase of coagulation, its relatively weak anticoagulant action may be termed "heparinoid" in nature. The relationship of various methods of isolation to anticoagulant property will be reported elsewhere (*9*). No correlation of the serum mucoprotein level with certain hemorrhagic syndromes reported to be associated with the presence of heparin-like substances (*10, 11*) in the serum has thus far been observed.

References

1. CHARGAFF, E., BANCROFT, F. W., and STANLEY-BROWN, M. *J. Biol. Chem.*, **115**, 155 (1936).
2. GREENSPAN, E. M., *et al. Cancer* (in press).
3. WINZLER, R. J., *et al. J. Clin. Invest.*, **27**, 609 (1948).
4. TOCANTINS, L. M. *Am. J. Physiol.*, **139**, 265 (1943).
5. SEEGERS, W. H., and SMITH, H. P. *Ibid.*, **137**, 348 (1942).
6. CHARGAFF, E., and OLSON, K. B. *J. Biol. Chem.*, **122**, 153 (1937).
7. JAQUES, L., and WATERS, E. T. *J. Physiol., London*, **99**, 454 (1941).
8. ALLEN, J. G., *et al. J. Lab. Clin. Med.*, **34**, 473 (1949).
9. GREENSPAN, E. M., *et al.* In preparation.
10. ALLEN, J. G., and JACOBSON, L. O. *Science*, **105**, 388 (1947).
11. SMITH, T. R., *et al. Ibid.*, **107**, 474 (1948).

The Percutaneous Absorption of Water Vapor[1]

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A recent paper by Szczesniak, Sherman, and Harris (*1*) described an experiment which demonstrated the percutaneous absorption of water by rats immersed in 40% deuterium oxide solution. This prompts us to report some observations we have made on the percutaneous absorption of water vapor, using tritium oxide as a tracer. Although there have been many studies and some controversy over the percutaneous absorption of water from the liquid state (reviewed by Szczesniak *et al.* [*1*]), there has not, to our knowledge, been any attempt to demonstrate such absorption of water vapor.

Our experimental procedure involved the exposure of a shaved area of the abdominal skin of 300- to 400-g rats to an atmosphere of tritium-labeled water vapor. The animals were under Nembutal anesthesia, and exposures were in most cases of 1 hr duration.

The exposure chamber consisted of the female member of a glass ball-and-socket type ground joint with a cross-sectional area at the open end of 6.6 cm^2. A small cup to hold the aqueous solution of tritium oxide was suspended in the chamber, and the open end of the exposure chamber was held against the rat skin by slight pressure. In some of the initial exposures the chamber was sealed to the skin with collodion, but later this precaution was found to be unnecessary.

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[2] Thanks are due R. C. Thompson for his cooperation and suggestions, and R. C. Thorburn for radioanalysis of the many samples required.

TABLE 1

PERCUTANEOUS ABSORPTION OF WATER VAPOR BY THE RAT FROM A SATURATED ATMOSPHERE AT 30° C

Method of sampling	Total No. exposures	µg water/cm^2 skin/min
Immediate blood sample	66	2.5 ± 1.3
24-hr blood sample	23	4.2 ± 1.2
Total body water sample	49	3.0 ± 1.5

The liquid in the cup does not come in contact with the skin but serves as a reservoir for the maintenance of an atmosphere saturated with water vapor.

The amount of water entering the animal was determined by radiometric analysis for tritium in either: (*a*) a blood sample withdrawn from the heart immediately following exposures, (*b*) a blood sample taken approximately 18–24 hr after the exposure, or (*c*) a sample of the body water obtained by azeotropic distillation of the ground animal with benzene. Analytical results obtained on the 24-hr blood samples were corrected for the biological half-life of tritium oxide in the rat, which time has been determined to be approximately 3 days. Details of the procedure used in the radioanalysis of samples and in determination of the biological half-life will be reported elsewhere.

About two thirds of the data were obtained from single exposures. The rest were obtained from experiments in which animals were exposed repeatedly at 24-hr intervals, the amount absorbed in a single exposure being determined by the difference in activity between pre-exposure and post-exposure blood samples. The variation between different exposures of a given animal was as large as that between exposures of different animals. The statistically summarized results are given in Table 1. It is obvious that complete equilibration of the absorbed water vapor with the body water did not occur until after the immediate post-exposure blood sample was taken. It has been shown previously that subcutaneously injected water in the human does not become equilibrated with the body fluids for a matter of several hours (*2*).

Considering the absorption/cm^2/min to be 4 µg, and taking 500 cm^2 as the total surface area of a 350-g rat (*3*), then 2,000 µg of water is absorbed by the rat per minute from an atmosphere saturated with water vapor. This is an interesting quantity compared with the water intake via the lungs which, assuming an air intake of 60 ml/min, would absorb 2,000 µg/min from the same atmosphere. The calculations for all data involving micrograms of water penetrating the skin were made with the assumption that tritium acts like hydrogen, even though this is probably not strictly true.

The effect of varying water vapor pressure and the extent of absorption in other animals are being investigated and will be reported in detail later.

References

1. SZCZESNIAK, A. S., SHERMAN, H., and HARRIS, R. S. *Science*, **113**, 293 (1951).
2. SCHLOERB, P. R., *et al. J. Clin. Invest.*, **29**, 1996 (1950).
3. DONALDSON, H. H. *The Rat, Data and Reference Tables.* Mem. the Wistar Inst. Anat. Biol., No. 6. Philadelphia, 122 (1924).