photographic paper, using the Hamilton optical recording manometer. A cannula attached to the manometer was directed cardially and tied into the left aortic arch. Body temperature was determined by means of a mercury thermometer tied into the cloaca. The animal was placed on its back in a pan of water, and the temperature of the water was changed slowly by the addition of ice cubes or by slow warming. The turtles were warmed from room temperature, 18°C, to about 40°, then cooled to about 3° and finally rewarmed to 45°. The rate of temperature change was about 0.3° per minute.

Arithmetic averages of the blood pressures and heart rates obtained in 2 heatings and one cooling of 5 turtles are given in Fig. 1. Our results show that there is a fairly consistent rise in arterial blood pressure as the cold animal is warmed until a temperature of about 38°C is obtained and with further warming the blood pressure falls rapidly. When the animals are then cooled the blood pressure increases until a temperature of about 38°C is obtained and with further cooling the blood pressure falls, so that in general the original curve is reduplicated. A second reheating gives data similar to that obtained in the first warming. The effect of temperature on heart rate is similar to that obtained with blood pressure, except that the heart rate is maximal at about 40°.

The pulse pressure remained relatively unchanged during our experiment. It decreased somewhat between 38° and 40°C when the heart rate was maximal, as can be seen in Fig. 1. It increased in 3 instances between 20° and 30°C in consequence of an unexpected fall of the diastolic pressure to zero.

Discussion. The rise in blood pressure seen with increasing body temperature may be related in some as yet undetermined way with the increased metabolic activity of the tissues. It is probably associated with an increase in cardiac output.

Comparison of our data on turtles with results on the resting blood pressure of unanesthetized mammals and birds, leads to the suggestion that there may be a general relationship between the body temperature and the level of the resting diastolic pressure. For example, the mammals (dog, rabbit, rat and man) which we have studied have all exhibited a basal diastolic arterial pressure of approximately 80 mm Hg.[1,2] These findings are in accord with scattered data found in the literature. Chickens, which have a normal body temperature of about 41°C, have a resting diastolic pressure of approximately 120 mm Hg.[3] Our data also appear to fit well with the relationship between blood pressure and body temperature in the new born rat, which has not yet attained the full development of the mechanism which assures homoiothermy.[4]

Summary. The arterial pressure of the turtle was found to vary directly with changes in body temperature between 3° and 38°C. Above 38°C the pressure declined.

[1] Katz, L. N., Friedman, M., Rodbard, S., and Weinstein, W., *Am. Heart J.*, 1939, **17**, 334.

[2] Rodbard, S., *Am. J. Physiol.*, 1940, **129**, 358.

[3] Unpublished data.

[4] Helmholz, H. F., Jr., *Fed. Proc.*, 1946, **5**, 44.

15486

Pressures Required to Produce Intradermal Wheals in Normal Human Subjects.*

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A search of the literature has not disclosed any previous attempts to measure the range of pressure required to produce intradermal wheals in the normal human skin. Such pressures should be a direct measurement of the force necessary to spread the closely-bound

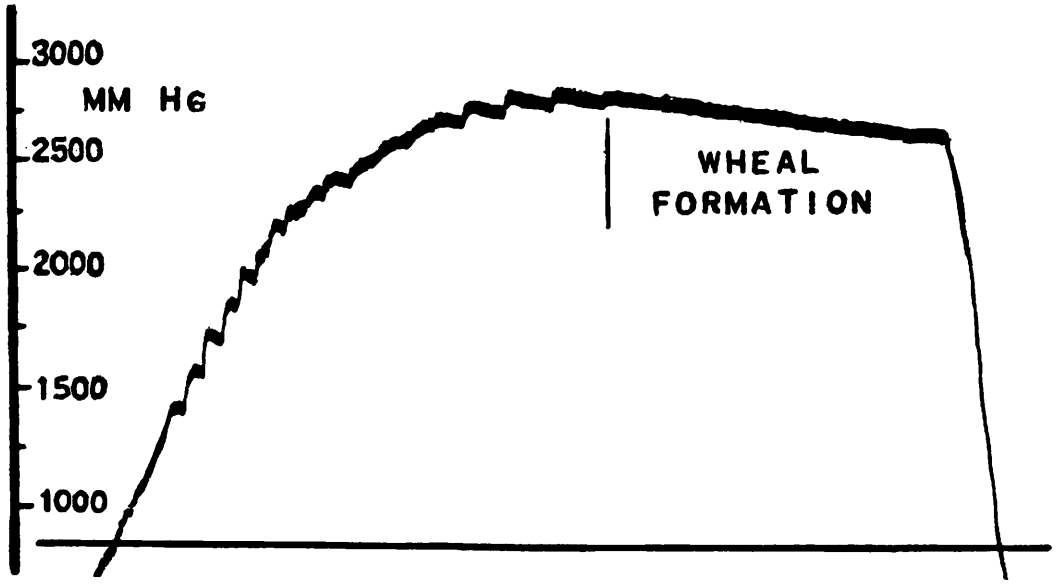

Fig. 1.

layers of the collagen connective tissue of the skin. Since natural changes may occur with varying degrees of hydration of the skin, the constancy of these pressures may be of clinical interest in such altered states as myxoedema and dehydration.

It was soon found that the pressure greatly exceeded that which could be measured by the usual Hg manometer and therefore the pressures were recorded optically. A glass spoon manometer was used with a calibration of 50 mm Hg pressure equal to 1 mm movement in the light beam which was recorded at 2½ meters on light-sensitive paper moving at a constant rate of 12 mm/second. The manometer was calibrated to 2750 mm of Hg by means of a mercury column. Wheals were raised on the lower half of the volar surface of the forearm, using a tuberculin syringe connected through a 3-way joint to the manometer and to a 27-gauge hypodermic needle ¼ inch in length. The pressure in this system was increased at a fairly rapid rate (approximately 750 mm Hg/second) until a wheal started to form. This position of the syringe plunger was then held until the wheal reached a diameter of 5 to 7 mm. To compare day-to-day variation, 5 measurements were made serially on each subject, and the average of these taken as the subject's wheal pressure for that day. Six male and 5 female subjects were used in this series.

Fig. 1 shows one of the typical pressure curves obtained. Even with this manometer it was necessary to set the zero level off the record in order to record on 60 mm paper the range of pressures involved. It should be pointed out that though we have not analyzed this part of the curve to date, the slope of the curve during wheal formation may be significant as a measure of cohesiveness of the collagen fibres of the skin.

The pressures obtained by this procedure are summarized in Table I. Considerable variation was found in consecutive readings. The average mean deviation of pressures made on the same subject on one day was 170 mm Hg with the bevel up, and 205 mm Hg with the bevel down. This is undoubtedly due to slight variations in the depth of the needle tip. Probably because of the inelasticity of the surface layers, measurements made with the bevel of the needle inserted up toward the epidermis were consistently higher than those made with the bevel down. Thus, the mean deviations on all subjects in each series and the large range of pressures in each case are not relatively as great as might be indicated by the individual figures. No consistent differences were found between

TABLE I.
The Pressures Required to Produce Intradermal Wheals.

No. of determinations	Characteristics of subjects		Bevel of Needle	Solution	Pressures—mm Hg		
	No.	Sex			Range	Mean pressure	Mean deviation
16	2	M	Up	Saline	1600-2800	2170	318
62	5*	M	Down	"	1000-3200	1970	454
14	3	F	Up	"	1900-3080	2240	128
24	5	F	Down	"	1280-2840	2160	400
44	4	M	"	Histamine acid phosphate 1-100,000 in saline	1260-3200	2460	405

* One Negro and one Japanese.

male and female skins, or among the skins of the Whites, Negroes, and Japanese studied. No attempt has been made in this preliminary study to determine the physiological variations in wheal-pressure which might occur with marked changes in environmental temperature or in the normal phases of the menstrual cycle. As shown in the table, the wheal-producing action of histamine is apparently too slow to lower the pressure required to produce wheals in this fashion. In fact the figures would rather indicate that histamine increased the pressure required.

Conclusion. The pressures required to produce intradermal wheals in normal individuals varied from 1,000 to 3,200 mm Hg with a mean pressure of about 2,000 mm Hg. No consistent differences in wheal pressures were found between males and females, or among Whites, Negroes and Japanese.

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Curative Action of Drugs in Lophurae Malaria of the Duck.*

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Scanty data have been published on the curative action of drugs in avian malarias, either in sporozoite or blood-induced infections.† No data has been published on the curative effect of drugs on lophurae malaria in the duck. For this reason, it appears advisable to record the following observations, despite the fact that the experiments are not perfectly controlled due to a large number of "accidental" deaths among our birds.‡

Infection was produced in ducks about 10 to 14 days of age by intravenous injection of 50×10^6 parasitized erythrocytes. The drug-diet method[1] of treatment was used. Administration of the diet was started 18 hours before infection and was continued for various lengths of time after infection. All drugs except SN 11,437, SN 187 and SN 475 were administered in the form of a salt.

* This investigation was done under a contract recommended by the Committee on Medical Research between the Office of Scientific Research and Development and The Johns Hopkins University.

† A considerable amount of data has been accumulated for various avian infections in the cooperative program of malarial research sponsored during the past five years by the Committee for Medical Research of the OSRD.

‡ These "accidental" deaths appear to be due to a filtrable agent. A preliminary study of this agent is reported elsewhere.[4]

[4] Dearborn, E. H., PROC. SOC. EXP. BIOL. AND MED., 1946, **63**, 48.

[1] Marshall, Litchfield, and White, *J. Pharm. and Exp. Therap.*, 1942, **75**, 89.