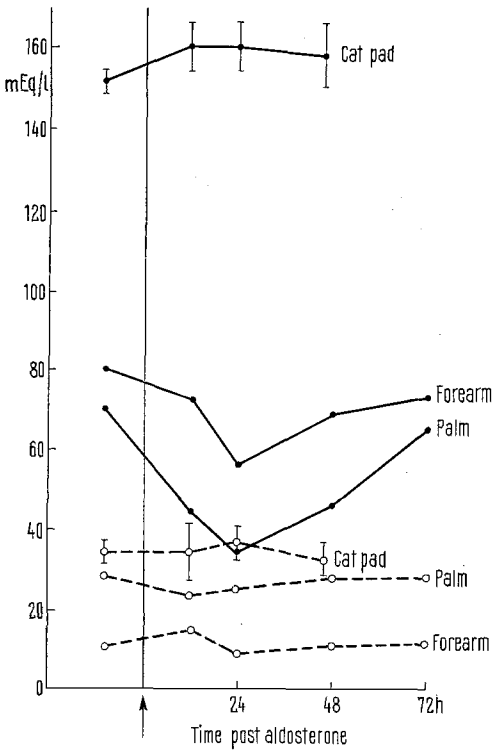
produced an effect on urine electrolytes similar to that with Aldocorten injections but analysis of sweat collected up to 24 h after haemorrhage failed to demonstrate any significant change in [Na] and [K] (Table II). Another possibility to be considered is that aldosterone may influence sweat electrolyte concentration only at low sweat rates. With stimulation frequencies less than 1 cycle/sec, [Na] was significantly reduced and [K] raised ($p < 0.001$); the sum of these cations being similar to that with higher frequency stimulation. It has previously been reported that the [K] in cat-pad sweat varies inversely with stimulation frequency below 2 cycles/sec[5,9] and the present observations are in agreement with this. Again, aldosterone had no effect on [Na] and [K] in cat-pad sweat produced with low frequency stimulation (Table II).



Effect of D-aldosterone on sweat sodium (●—●) and potassium (○---○) concentrations in cat's pad sweat (± S.E.) produced by nerve stimulation (1–3 cycles/sec) and by acetylcholine injection in the forearm and palm of one subject.

The finding that aldosterone promotes Na-retention in human forearm and palmar glands but not in cat-pad glands may be explained on morphological grounds. The ducts of the glands in the cat-pad are rudimentary and the ductal cells contain few mitochondria as compared with human forearm glands[10]. Other mammalian exocrine glands such as the lachrymal, pancreatic, sublingual and palatine glands with no regional duct differentiation are similarly unresponsive to aldosterone[11]. The cat-pad glands are therefore experimentally useful as a preparation for studying the eccrine secretory process unmodified by ductal reabsorption. In our view, human palmar glands correspond to those of the cat's pad with regard to function (i.e. they respond only to psychogenic stimuli), but they differ morphologically[12] in possessing a duct segment similar to general body eccrine glands.

Zusammenfassung. Nachweis, dass Natriumretention bei der menschlichen Temperaturregulation und in den exokrinen Schweissdrüsen der Handflächen von Aldosteron verursacht wird; dies im Unterschied zu den Drüsen in Katzenpfoten, welche charakteristischerweise vom exokrinen Sekretionsprozess des duktalen Ionenwechsels nicht beeinflusst werden und weder auf Aldosteron noch auf Blutung reagieren.

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Thermoregulatory Heat Production by Periaortic Brown Adipose Tissue in the Non-Cold-Acclimatized Rat

Since SMITH[1,2] suggested that brown adipose tissue might be an important source of thermoregulatory heat production, this has been shown beyond doubt to be true in the cold-adapted rat[3], the non-cold-adapted rat[4], the warm-adapted rat[5] and for the new-borns and adults of a number of other species[6–12], including the human neonate[13–16]. Changes in brown adipose tissue temperature in the course of changes in thermoregulatory heat production were measured exclusively in the interscapular

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brown fat body, and heat production by the total amount of brown adipose tissue was also extrapolated from measurements of oxygen consumption of the interscapular brown fat[17].

To investigate the role of the periaortic brown adipose tissue in thermoregulatory heat production, a sonde consisting of 2 copper constantan thermocouples 35 mm apart was introduced through the femoral artery into the aorta so that the tip with one of the thermocouples came to lie in the aortic arch, the distal thermocouple being located a few mm above the diaphragm. Another thermocouple was implanted into the interscapular brown adipose tissue. The operation was performed under i.p. hexobarbital anaesthesia, and the observations were started 15–18 h later, when the animals had completely recovered from the anaesthetic. In other respects the experimental setup was identical with that described elsewhere[5].

The thoracic aorta of the rat is enveloped by brown adipose tissue. On both sides the brown fat layer is fairly thick; in the front, the wall of the aorta may not be covered completely by brown fat.

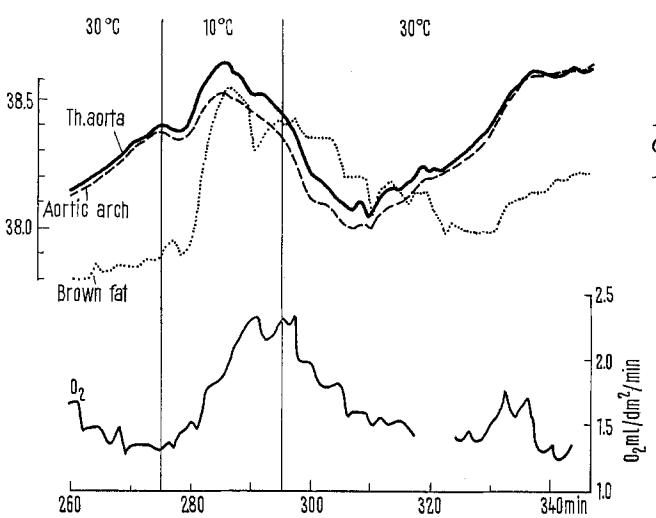
The Figure shows the response to cold exposure. At the thermoneutral temperature there was no difference, in this instance, between the temperatures measured by the thermocouples located in the aortic arch and 35 mm distally in the thoracic aorta. Following exposure to cold, however, simultaneously with the sharp increase in the temperature of the interscapular brown adipose tissue and in oxygen consumption, the temperature of the blood in the thoracic aorta rose well above that measured at the aortic arch. This difference was maintained after re-transfer to the thermoneutral environment for about 20 min and disappeared when oxygen consumption had declined to the pre-exposure level and the temperature of the interscapular brown adipose tissue had declined well below the aortic temperature. In some instances the distal point in the aorta may be warmer than at the aortic arch also in a thermoneutral environment, in these cases this difference increased in response to cold exposure, and, after re-transfer to the thermoneutral environment, the increased temperature difference was reduced again to the pre-exposure level. The Table summarizes the results of more than 50 cold exposures on 12 animals.

This phenomenon was not found in the adult guinea-pig, which has no periaortic brown adipose tissue.

It appears to be justified to conclude that, in the cold, a not negligible amount of heat is transferred from the periaortic brown adipose tissue to the blood in the aorta. A very rough and approximative calculation, based on data of cardiac output in the rat and its increase in response to cold[18,19] and assuming that about half of the cardiac output flows through the thoracic aorta, indicates that, in the cold, 5% or more of the total heat production is transferred to the blood flowing from the aortic arch at a distance of 35 mm.

	Body weight (g)	Increase in temperature between the aortic arch and the thoracic aorta 35 mm distally (°C)		Oxygen consumption (ml/dm²/min)	
		Environmental temperature 30 °C	10 °C	Environmental temperature 30 °C	10 °C
Mean	265	0.04	0.08	1.41	2.49
± S.E.	± 8	± 0.004	± 0.005	± 0.02	± 0.04
n	12	59	58	51	51
p		0.001		< 0.001	

Zusammenfassung. Mit Thermoelementen im Aortenbogen und 35 mm distal davon gemessener Temperatur zeigt sich in thermoneutraler Umgebung entweder keine oder nur eine geringere Temperaturerhöhung des distalen Punktes. In kalter Umgebung hingegen ist die Differenz signifikant vergrössert.



Temperature in the aortic arch (---) and 35 mm distally in the thoracic aorta (—). Temperature of interscapular brown adipose tissue (·····). Oxygen consumption (—). The abscissa records the time elapsed since measurements of oxygen consumption and temperatures were started. For details see text.

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