Fig. 1. The changes of respiratory-rate (●), rectal temperature (O-O) and scrotal skin temperature (●-●) induced by heating the scrotum of a ram with air at 45°C.

The falls of skin temperature occurring during the heating coincide with mass discharges from the sweat glands of the scrotum (Waites, unpublished observations)

panting, but a rapid polypnoea associated with a moist muzzle.

To confirm that the scrotal skin of each ram was specially sensitive to temperature, an area of mid-side skin equal to the area of the scrotum was close-clipped and heated with air at 45 ± 1°C. The respiratory response was negligible: mean frequencies were 45–65/min. during the control period, and 43–71/min. during the heating. It must therefore be concluded that the skin of the scrotum of the ram is particularly well endowed with peripheral thermal receptors.

No change in rectal temperature was detected before the start of the polypnoea, but thereafter rectal temperatures fell by 0.3–1.25 deg. C. in all experiments. In 7 of the 12 experiments, rectal temperature dropped at the rate of 0.5–1.0 deg. C./hr. and in these the fall started sharply within 8–18 min. after the onset of the polypnoea (Fig. 1). If the thermal inertia of the rectum of the ram is the same as that of the calf², then changes in rectal temperature would lag behind changes in blood temperature by 5–10 min. This would mean that in these experiments the temperature of the blood supplying the brain starts to fall almost immediately after the onset of the polypnoea. Furthermore, the polypnoea was sustained in spite of the continued rapid fall in deep-body temperature,

a response which is paradoxical since the air ambient to the rest of the body was cool.

Thus, these results support the view that a thermally induced polypnoea can be evoked in rams without a previous rise in central temperature. Moreover, they show that the fall in deep-body temperature which followed the increase in respiratory-rate did not extinguish the reflex while the scrotal skin was being heated. The nature of the receptors and their pathways have yet to be described. However, it is now apparent that in the ram the scrotal cutaneous receptors alone are capable of influencing general body temperature, giving a broader thermo-regulatory role to the scrotum than the purely local one previously considered^{7,8}.

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Polypnoea evoked by heating the Udder of the Goat

At the suggestion of Dr. Waites (preceding communication), we have similarly tested the udder of the female goat, because the sensory innervation of the udder and the scrotum are essentially the same¹.

In seven tests on 2 non-lactating pregnant Saanen goats, the immersion of the udder in a stream of air at 45°C. caused a rise in respiratory frequency from 20–40/min. to 100–120/min. after a latency of 5–60 min. Neither passing air at udder-skin temperature over the udder nor heating an equivalent area of the abdomen in front of the udder had such an effect. In two tests on a third dry, non-pregnant goat with one mammary gland transplanted on to the neck², the heating of this denervated gland was without effect on respiration, but when the control gland in the normal position was heated, the onset of panting occurred after 20 min. Although the rectal temperature tended to rise during the periods in the laboratory, the onset of polypnoea could not be related to this rise, which occurred equally in control experiments.

These preliminary observations confirm the finding of Waites that the inguinal region appears to be more sensitive to temperature than the general body surface of ruminants.

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