THE INFLUENCE OF HIGH TEMPERATURES ON THE TESTIS.

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The investigation described below was undertaken to find out whether there might be some correlation between the general adoption of hot bathing by the wealthier classes since about 1850, and the fall in their birth-rate since that date. Evidence had been brought forward by Crew (1921) and Moore (1924) that the function of the scrotum of Mammals is to maintain the testes at a temperature somewhat below that of the rest of the body. In order to test this hypothesis, Moore exposed the testes of guinea-pigs to water at temperatures varying from 44 to 47° C., sometimes running hot water on to the scrotum, sometimes opening the scrotum, pulling out the testes and bathing them in hot saline solutions. He found that a stream of water at 47° C., kept running for only 10 minutes, had such a deleterious effect that 12–20 days later the external part of the testis was completely degenerate and lacking in spermatozoa. Ten minutes' immersion of the testes in a saline bath at 46° C. sufficed to make every tubule degenerate. He also found that repeated applications of hot water had greater effect than a single application. He showed that single applications of water at 44° C. had practically no effect, but did not test the effect of repeated applications of water at temperatures at which a single application had no effect.

It occurred to me that it would be interesting to study the effects of repeated applications of water at the temperature of an ordinary hot bath. I chose dogs for the experiment, as preferable to rodents in having a better-formed scrotum exposing more of the surface of the testes to the exterior.

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Method.

The experiment was carried out upon three fox-terriers, which were all kept together and fed on the same food. The testes of one dog, which may be distinguished as "A," were subjected to running water at 39·5–40·0° C. for 10 minutes a day daily for 28 days (from March 18 to April 14, inclusive of both dates)[1]. The control, "B," was not subjected to any such treatment. A third dog was treated twice, but for reasons which will become apparent need not be considered further.

[1] On two occasions the applications were rather shorter, owing to failure of the hot water supply, so a correspondingly longer application was given the next day.

The supply of water at 39·5–40·0° C. was produced by joining the hot and cold taps of the domestic water supply with a rubber tube. When a sufficient quantity of water had been allowed to run to waste in order to warm the pipes, its temperature became very constant. A thermometer being held in the stream, the temperature could be kept within the limits of 39·5–40·0° C. during the 10 minutes' treatment, with only momentary lapses outside these temperatures.

The stream of water, which flowed at the rate of about $2\frac{1}{2}$ litres a minute, was directed on to the scrotum of the dog, which was held on its back or side. The scrotum was gradually accustomed to the high temperature at the beginning of each application. The 10 minutes were timed from after this preliminary warming.

The dogs were killed on the 28th day of the experiment, and the testes removed and weighed. Pieces were teased in Ringer's solution and examined under the microscope for spermatozoa. Pieces from just below the albuginea were fixed in Flemming's fluid. Some of the sections were stained with safranin and light green, while others were mounted unstained.

The diameter of the seminiferous tubules was measured, and the stage in spermatogenesis reached in each of about 40 tubules noted. (In recording the stage in spermatogenesis, no notice was taken of the presence of a few sperms or spermatids in tubules in which far the greater part of the lumen was bounded by cells of an earlier stage.) The unstained sections were examined to find whether any fatty degeneration had taken place.

Results.

The essential results of the experiment are recorded in the table. It will be observed that there is little difference between the testes of the experimental animal and those of its control. There was no sign of fatty degeneration. The interstitial cells of both animals were similar. One difference between the two

	B (Control)	A (Experimental animal)
Weight of testes as percentage of body-weight	0·154 %	0·194 %
Motile sperms	Present	Present
Interstitial cells	Normal	Normal
Signs of degeneration	None	Very slight
Diameter of tubules (mean of ten)	24·7 units	21·7 units
Percentage of tubules reaching to following stages in spermatogenesis:		
2nd spermatocyte and earlier	0 %	6 %
Spermatid before elongation	45	20
Elongating spermatid	25	40
Fully-formed spermatozoon	30	34

is that there were a few degenerating cells in some of the tubules of the experimental animal "A"; but since this is not unusual in testes, not much significance must be attached to it. Another difference is that in the control "B" no tubules were observed with spermatogenesis only reaching to the second spermatocyte stage or earlier; but only a very few such tubules were

observed in the experimental animal. Until the experiment is repeated on a large scale it would be unjustifiable to attribute these small differences to the treatment of the scrotum with hot water.

The third dog, which was only exposed twice to the hot water, had normal testes.

SUMMARY.

The subjection of the scrotum of the dog for 10 minutes daily for 28 days to a stream of water at 39·5–40·0° C. does not materially affect the testes. It is unlikely that ordinary hot bathing affects male fecundity.

REFERENCES.

CREW, F. A. E. (1921). *J. Anat.* **56**, 98–106.
MOORE, C. R. (1924). *Am. J. Anat.* **34**, 337–358.

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