September 1972 B72-10559

NASA TECH BRIEF

Ames Research Center

A Thermocouple Thermode for Small Animals

The problem:

A popular technique used in the study of thermoregulation in animals involves manipulation of the central nervous system temperature by implanted thermodes. However, the relatively large size of most thermodes limits their use to large animals, and the inability to obtain the exact tip temperature during perfusion has prevented quantitative expression of results.

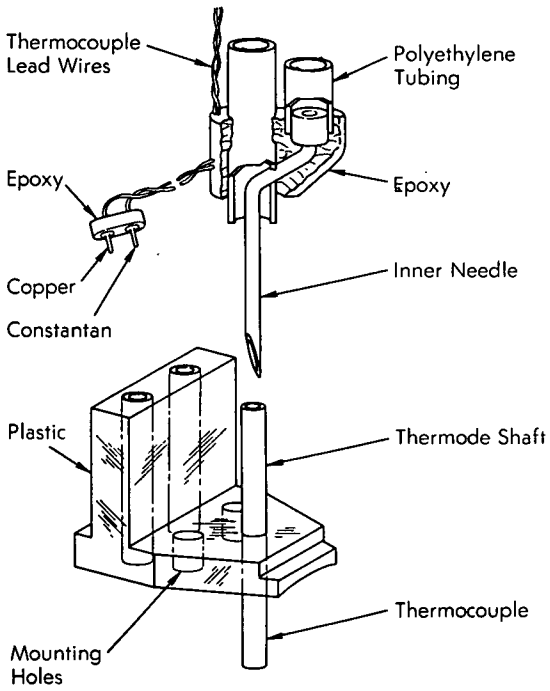
The solution:

A thermode which is comprised of two thin-walled stainless steel hypodermic needles and a copper–constantan thermocouple or a small thermistor to indicate temperature at the point of perfusion. Moreover, the thermode has two parts: the actual thermode shaft which is chronically implanted in the brain and an inner unit that can be inserted into the thermode shaft for perfusion; thus, the inner unit can be conveniently removed when data are not being recorded.

How it's done:

Two standard hypodermic needles are used, one fitting loosely inside the other; since many combinations can be selected, the overall size of the thermode can be varied to accommodate required fluid flows. Larger perfusion distances will require a larger diameter perfusion tubing because of increased resistance to flow. The larger hypodermic needle becomes the thermode shaft, closed at one end with stainless-steel solder and then ground and polished to a blunt point.

Perfusion lines in sizes appropriate to the small thermode diameter create a high resistance and make it difficult to maintain a suitable flow. The resistance can be minimized by using a tubing coupler to permit use of larger tubing for most of the perfusion distance and by keeping the perfusion distance as short as possible; a small amount of wetting agent added to the water bath also tends to reduce resistance to flow. Once suitable flow rates are obtained, the thermode is calibrated by monitoring tip temperature over a range of water bath temperatures.



(continued overleaf)

A block of plastic material cut as indicated in the diagram forms the body of the thermode-thermocouple; holes drilled in the block accept the thermode, thermocouple sleeves, and mounting screws. The length of the thermode shaft (press-fitted into the plastic body) is determined by the depth of the target structure; in general, the shaft is lowered to the target structure with the aid of a stereotaxic device, and then the plastic body of the thermode is anchored in place with dental cement and two stainless steel screws. The bottom of the body may be shaped to mate the curvature of the skull of the animal to which it is attached. Copper and constantan tubing of about 0.8-mm diameter are pressed into holes in the plastic body to mate with corresponding portions of the thermocouple plug that are fabricated from copper and constantan rods.

Because of the relatively small size of the thermode, structural damage to the brain is minimized, and since the measurement of brain temperature is taken directly at the point of thermal stimulation, the device removes the need for a second penetrating tube for a thermocouple or thermistor.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: TSP72-10559

Patent status:

NASA has decided not to apply for a patent.

Source: Bill A. Williams
Ames Research Center
(ARC-10550)