

APPENDIX

Foot Withdrawal Response to Noxious Radiant Heat in the Rat

In the living animal, the temperature at the target site, to which the infrared (IR) beam is applied, is definitely an elusive datum.

Physiological and anatomical features significantly affect "temperature". Heat transfer constantly occurs via vascular flow, dissipating the heat from the site where the IR stimulus is applied. Obviously, the extent of vascularization of the target site affects the heat transfer from the stimulated site. And although vascularization of tissue is generally comparable between animals, there also may be a measurable degree of variation among test animals within a group.

Pigmentation strongly affects the rate of absorption of heat; it is well known that darker skin will "heat" more quickly than lighter areas of the epidermis.

Further still, temperature measurements (using subdermal thermocouples or thermistor probes, etc.) are affected by variation between experimental animals, due to small or great differences in the orientation of external probes or sensors, due to variation in depth of subcutaneous implantation of subdermal probes, and perhaps even more seriously, due to tissue damage when positioning subcutaneous probes or sensors.

There is a relevant and logical solution to these questions about temperature; one should measure a parameter that is able to be quantified, and is not affected by the physiological and anatomical problems which affect "temperature", per se.

An objective way to quantify the intensity of the IR stimulus is to calibrate its power. Power may be quickly and definitively be measured in mW per square centimetre, by a suitable radiometer (see our Cat. No. 37300).

To quantify power of the IR stimulus is to measure something certain. Any measure of power is a metric not subject to the above physiological and anatomical variation lacking in definiteness and precision.

The power of the IR stimulus, in physical sense, is the basic parameter. We know by experience with this type of experiment, that the animal reacts to the stimulus after a certain time (latency) at a certain IR power. Power multiplied by time is equal to energy, which is a parameter that we can measure in Watts per second or Joule.

The experiment therefore delivers a certain quantity of energy. Classical experiments show that the threshold of pain takes place at epidermis temperature of 45°C.

Heat transfer and absorption may be affected by treatment, whether anti-inflammatory drug treatment, nerve blocking drug CIA, induced inflammation, nerve injury, etc.

The pathophysiology of any injured site is quite different from a non-treated site, and the temperature fluctuation via vascular heat transfer becomes a relative and moot term, further complicating comparison of heat per se.

It is obvious that the instruments Plantar Test and Tail Flick are not lesion making devices; they are not meant to be. The threshold of irreversible tissue damage should not be reached. In an uninjured paw or tail, experimentation should be a sequence of algisia tests carried out on consistently sound tissues.