results: the values chosen in the present study were merely those which gave roughly comparable responding in a free-operant situation, but they did seem to yield reasonably similar performances on the first discrimination. It is also possible that the site of intracranial stimulation would influence the relative permanence of conditioning, but this remains a problem for future research. Finally, the results suggest that persistence of responding in reversed-discrimination situations may be a useful index of efficacy of reinforcement, since it appears to be sensitive to differences in reinforcement and at least partially independent of two of the more frequently employed measures, response rate and error elimination in original learning (*7*).

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Semantics in Biothermal Studies

Abstract. Only by the use of accurate and meaningful words pertaining to body temperatures and heat sources can our understanding of the ecological and physiological functioning of vertebrate organisms be clarified. Since the classical terms are inadequate, other terms that are already in use should be used.

The use of more appropriately descriptive terms in classifying thermal types among the vertebrates was originally proposed in 1940 (*1*) and explicitly reanalyzed and emphasized in 1947 (*2*). Since that time there has been an increasingly widespread acceptance of *ectotherm* in place of *poikilotherm*, and *endotherm* in place of *homoiotherm*. Less widely adopted have been *heliotherm* for those vertebrates that rely on periodic basking for their thermoregulation, and *thigmotherm* for those organisms that derive their effective body temperatures solely from the medium in which they live, water or soil. The latter have little or no capacity for thermoregulation other than by micro or macro migratory avoidance of excessive environmental thermal changes. Examples of thigmothermic vertebrates are fish; completely aquatic amphibian larvae and adults; marine turtles and sea snakes, though these may "bask" or at least float with parts of the body exposed to sunlight; burrowing snakes and lizards; and strictly nocturnal though surface-feeding amphibians and reptiles. All of these are primarily, at least, thigmothermic ectotherm organisms.

An occasional but increasingly encountered and confusing misuse of precise nomenclature is the substitution of the word *heterotherm* for *ectotherm* or *poikilotherm* as though it were equivalent. With increasing evidence for, and without evidence to the contrary, it can be presumed from all available information that most if not all terrestrial and marine vertebrates have specific thermal preferences or optima nearly as precise as those that characterize some of the endotherms. They appear to differ from the endotherms chiefly by their thermal plasticity when avoidance of unfavorable temperatures is impossible. If or when vertebrate animals are found that have no optimum and therefore flourish equally well throughout a wide range of temperatures, they should be called *eurytherms,* but they will nonetheless be ectotherms.

The term *heterotherm* should be retained in its original sense, that is, for those organisms which for some presently unknown reason or reasons are incapable of relying solely on either metabolic or external sources of heat under even moderately varying environmental temperatures. Employed in this manner, examples of heterotherms include at least some of the hummingbirds, some swifts, the western poorwill, probably the speckled coly (*Colius striatus* of Africa), and many nearctic bats. *Heterotherm* is the appropriate designation for these ambivalent compromisers between ectothermism and endothermism.

The ecologically semantic utility of these terms lies in the fact that each calls attention to the fundamental difference in sources of body heat. From the physiological-ecologist's point of view there is a vast difference in energy economics between ectotherms and endotherms. For example, in endothermic organisms insulation conserves body heat and energy supplies, whereas it would effectively deprive ectotherms of most of their successful reliance on incoming radiant energy. In a similarly reversed manner the thermoregulatory function of an ectotherm's vascular system is primarily that of heat-uptake and distribution of this heat into the body, whereas in the endotherms the energy-expensive heat generated by metabolic processes in deeper tissues is carried outward to the surface where it may be lost. Recognition of these simple but fundamental differences immediately clarifies the functioning of attendant phenomena in a manner that is unattainable with the older nomenclature.

Insofar as comparative endocrinologists and physiologists become interested in the ectotherms it is abundantly clear to students of temperature that a much more pointedly descriptive nomenclature would be helpful, and might result in more useful studies than many of those that have been done in the past in these fields. So long as nonbiothermal specialists are beguiled by inaccurate thermal terms and therefore are led to think in the misleading older designations for thermal types, we can scarcely expect them to abandon the now nearly universal custom of conducting experimentation based on the resulting ambiguous assumption that for "poikilothermous" vertebrates room temperatures, or for that matter almost any nonlethal or nonextreme environmental temperature, will give meaningful, standard, and reproducible results.

From the vertebrate ecologist's approach, the source of heat and the regulation of body temperatures, involving as they do among other things, food and the energy balance, shelter, adaptations to climate, and the annual activity cycle, are certainly sufficiently important to justify the use of the most precise and descriptive terminology available. This insistence on accurate, verbally oriented thinking should be particularly true for those interested in any aspect of ectotherm research (*3*).

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20 September 1961