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HOMEOTHERMY AND POIKILOTHERMY

Homeothermy and Poikilothermy The achievement of "thermodynamic freedom" by homeothermic (constant-temperature or warm-blooded) animals, who can maintain a practically constant internal temperature regardless of changes in external temperature, is undoubtedly the most significant advance in regard to the manifold relations between temperature and living beings. In contrast to the poikilotherms, whose vital processes depend entirely on external temperature conditions, homeotherms - birds and mammals - live at practically the same level of intensity during the entire year, and in all climatic regions; thus, they have a high level of reactivity, and can make use of their strengths and abilities whenever they desire. Their high internal temperature prevents them from freezing, which is the fate of poikilotherms under cold conditions unless they can retire to deep waters, to frost-free layers of the soil, or to warmer climatic zones, or unless they can survive in desiccated, encapsulated form. The geographic distribution of homeotherms is thus not as limited as that of poikilothermic forms of life, especially plants, which cannot change locality in order to avoid unfavorable temperatures. In regard to the direct influence of temperature, warm-blooded life is possible practically everywhere on earth; in regard to other factors, however, there are naturally a number of practical limitations, among them the problem of nutrition, which is also dependent upon temperature. There is no clear-cut distinction between homeothermy and poikilothermy. On the one hand, many poikilothermic fOlms of life show rudimentary signs of temperature regulation. This is particularly true for certain species of reptiles which have a striking ability to regulate their body temperature within narrow limits by behavioral means and, to a certain extent, even by metabolic changes. For example, the "heliotherms" among the reptiles regulate shuttling between sun and shade and orienting positively or negatively to the sun's rays. However, their body temperature may vary by 20° C and more according to internal and external conditions. Furthermore, reptiles may abandon normal behavioral temperature regulation while defending a territory or avoiding a predator. On the other hand, some warm-blooded animals have extremely imperfect control over their

body temperature. In the course of ontogeny, homeothermy was developed only gradually, and a certain group of warm blooded animals is poikilothermic for a certain time after birth. A special position is occupied by those warm-blooded animals which go into hibernation or other forms of immobility under certain conditions, and thus spend a period of "vita minima" at body temperatures of a few degrees above the freezing point. Warm-blooded animals with relatively great fluctuations in body temperature are called heterothermic; however, this term cannot be clearly defined, since it includes all the stages between homeothermy and poikilothermy. The basic differences in body temperature control in the cold existing between poikilotherms, homeotherms and hibernating homeotherms. With falling environmental temperature the body temperature of poikilotherms declines continuously. In some insects it may fall below the freezing point, with death occurring after a sudden increase in body temperature. The body temperature of homeotherms is maintained at normal over a wide range of cold stress; but with cold stress progressing beyond a critical point, homeothermy breaks down and death ensues. Large and well-insulated homeotherms can survive much lower environmental temperatures than hibernators. The body temperature of hibernating homeotherms approaches freezing point but is prevented from falling below it.

Temperature has a fundamental influence in all chemical and biochemical reactions. It influences reaction rates, equilibrium amounts, viscosity, solubility, molecular arrangements and numeric other parameters. Temperature is important for all physiological processes. Maintaining the relative constancy of the internal temperature (temperature homeostasis) is a necessary condition for normal life. Some living beings maintain temperature homeostasis in the body due to external sources of energy (poikilothermy), others due to the energy of food consumption (homeothermy). However, it is unknown the origin of homeothermic organisms. Despite the fundamental similarity of the mechanisms of the central organ-based physiological thermoregulation, even among the higher vertebrates exists poikilothermy and homeothermy animals. It is assumed that homeothermy is not the result of the evolution of physiological mechanisms of thermoregulation. Homeothermy is the result of the evolution of non-coding DNAs in the genome, some of which formed the so-called chromosomal heterochromatin regions (HRs). Chromosomal HRs constitutes the material basis of cell thermoregulation, which is responsible for the removal of excess thermal energy from the nucleus into the cytoplasm. Homeothermic organisms, unlike poikilotherms capable of faster and more efficient leveling of temperature difference between the nucleus and the cytoplasm with all the ensuing consequences .