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COLD ADAPTATIONS IN RODENTS IN NATURE AND IN LABORATORY

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During 15 years authors studied cold adaptations in small rodents both in natural winter conditions and in laboratory (experiment). The species at study were those typical for Subarctic regions, as Lemmus sibiricus, Microtus middendorffi, Dicrocnostonyx torquatus; species characteristic for mountains: Microtus juldaschi, M. carruthersi, Alticola lemminus, A. argentatus; as well as the population of species with vast areas: Clethrionomys rutilus, C. glareolus, M. oeconomus. All the species studied reveal subnival activities combined with high lability and variability. In laboratory (vivarium) animals of Subarctic and mountains species demonstrate day-light duration. Typical inhabitants of Subarctic and mountains possess integuments with higher thermo-isolating qualities as compared to those of the animals of the widespread species though inhabiting northern or mountain regions. In the northern mountain species thermoconductivity of pelts in summer and in winter differs but slightly; for example, in Alticola lemminus the figures are: 0.195 cal/sec/degree/sq.cm in summer and 0.190 in winter. In subarctic and widespread species the seasonal differences by this item are as follows: 0.189 cal/sec/degree/sq.cm in summer and 0.170 - in winter.

Studies of variatorius of resting metabolic rate values (pO2ml/g/hr) and rectal temperatures (C°) in adult males held at low temperatures (-20°C) during 30 minutes indicated clear differences in reaction of animals of the different ecological groups mentioned above. Thus in Lemmus sibiricus these two indices were equal to: 9.22±0.07 and 33.1° at + 20°C; 11,34± 0.1 and 26.2° at -20°C. In microtus middendorffi the figures were as follows: 7.79±0.3 and 31.7° (+20°C); 9.05±0.15 and 27.6° (-20°C). In Clethrionomus rutilus from Yamal, correspondingly: 6.54±0.34 and 37.2° (20°C), 15.02±0.4 and 35.3 (-20°C), in M. oeconomus from the South Urals:3.6±0.29 and 37.6°,6.1±0.1 and 32;1°.

Analysis of results has shown the different ways od adaptations to low temperatures observed in specialized species

and populations of widespread animal species, both at the levels of quantitative and qualitative shifts of metabolic processes in cells. In C. rutilus from the Yamal pensinsula (67°N) and from the Middle Urals (57°N), in L. sibiricus and in laboratory mice (CBA-line) there were shown to exist the differences between animals at the initial condition and those after being held in thermocamera at C°C during 3 or 14 days, by the intensity and character of regeneration processes in the blood system, liver, gut, kidney, heart, some other tissues. Mode of reaction of functional systems depends upon specialization of a group and upon level of cold adaptation in animals. Thus, after 3 days of cold effect blood system in all animals studied demonstrated erythropoiesis increase, the reaction being expressed to the most extent in L. sibiricus and C. Rutilus from Yamal. After 14 days of cooling, characteristics remain constant in the "northern" animals while in the voles from middle latitudes and in laboratory mice intensity of hemopoiesis is seen to be decreased. In subarctic animals (species) cells of hemoplastic system show the ability to be more effective when oxidizing substrata.

Differently to long-termed cold adaptations in rats, winter adaptations in lemmings and high-mountain voles mean but the decrease of the intensity of energy exchange, the ability for better usage of oxygene: the most metabolic shifts being observed at the temperatures typical for their constant winter life (-10-20°C).

All the data obtained work to support the theory by S.S.Schwarz A.D. Slonim, V.N.Bolshakov about the different character of adaptations directed to support energy balance under the conditions of cold.