【Grant-in-Aid for Transformative Research Areas（B）】

Section III

Title of Project： Mammalian hibernation biology ~ survival strategies via hypometabolism and hypothermia

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【Purpose of the Research Project】

Mammals are homeotherm in that they have the capacity to maintain core body temperature by thermogenesis even in the cold. However, it is difficult for them to meet energy demands for thermogenesis in harsh cold period with little or no food. To survive during such period, some mammals utilize “torpor”, in which their core body temperature drops to the level near ambient temperature by reducing thermogenesis. When torpor occurs seasonally and repeatedly, it is called “hibernation” (Figure). The fact that hibernation and torpor is widely observed among mammalian clades leads to the assumption that some modifications in systems governing body temperature homeostasis may allow mammals to hibernate. However, to date, little is known about regulatory mechanisms of torpor and hibernation, possibly due to limitation of animal models to study the causal relationships between those phenomenon and molecules including genes, proteins and so on. In this research project, we aim to introduce new technologies into hibernation research field, thereby providing molecular clues to mechanistic understandings of hibernation and torpor.

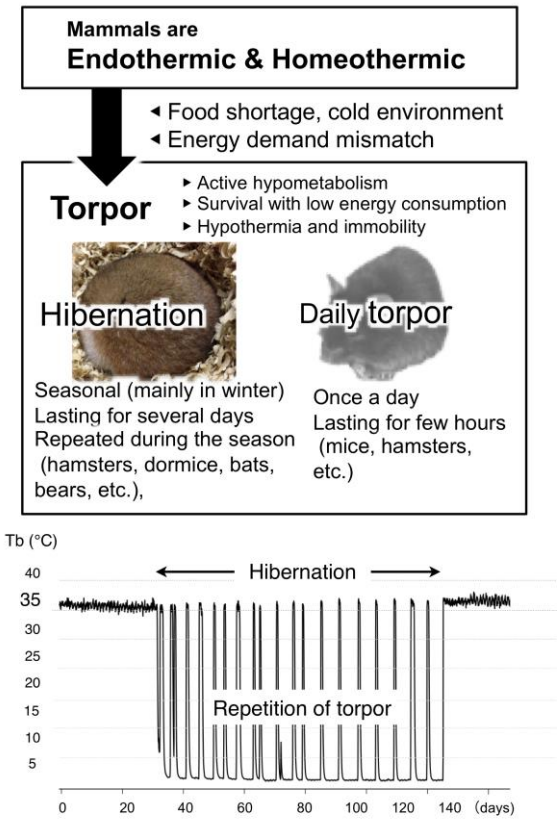

Figure. Hibernation and Torpor in mammals

【Content of the Research Project】

Our group consists of members who are specialists of the following topics or techniques; induction of hibernation / torpor / hibernation-like state, temperature receptors, circadian clock, breeding of hibernating animals, genetically modified animals, and live imaging techniques, etc. Focusing on the molecular network responsible for active hypometabolism and hypothermia, both of which are considered to be the essence of hibernation and torpor, we will conduct research from the viewpoints of gene function, signal dynamics, and so on.

We will hold innovative and creative symposiums and meeting on hibernation and torpor research. To facilitate interactions and communications among researchers who are interested in hibernation, we are going to establish a website for an “Web forum for hibernation and torpor research” to share information on research papers of those topics.

【Expected Research Achievements and Scientific Significance】

Hypothermia that should be experienced during torpor causes cytotoxicity and organ damage and is fatal to non-hibernator mammals such as humans and rats, but no such defects are found in mammalian hibernators. This research project will elucidate the molecular mechanism of hibernation by providing new methodologies and molecular clues into hibernation research field, thereby opening up a new avenue in the field and have a ripple effect on a wide range of other fields.

【Key Words】

Torpor in mammals: the hypothermic, hypometabolism, and immobile state of animals, which could be achieved by active, not passive, suppression of thermogenesis.
Hibernation: the situation when torpor occurs repeatedly and frequently during a season.

【Term of Project】

FY2020-2022

【Budget Allocation】

122,100 Thousand Yen

【Homepage Address and Other Contact Information】

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