

# Living in a Seasonal World

Thermoregulatory and Metabolic Adaptations

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# Preface

“Climate plays an important part in determining the average numbers of a species, and periodical seasons of extreme cold or drought, I believe to be the most effective of all checks.” With this remark in his book “On the Origin of Species”, Charles Darwin (1859) identified the seasonality of environments as one of the most important forces in natural selection. Darwin was well aware that “characters appearing periodically at different seasons” are widespread among animals (*ibid.*), and that many species, including those in the tropics, respond to unfavourable conditions by using torpor and “hibernation”. Darwin was, however, largely ignorant about the physiological mechanisms underlying these phenomena, as physiology was still in its infancy during his time. Only a few years later though, in 1865, Claude Bernard described several fundamental characteristics of hibernation, and in the 1870s Alexis Horvath wrote a series of influential papers on hibernation in European rodents. In 1896 Raphael Dubois then published a seminal study on the physiology of the hibernating marmot. Still, work on this topic remained sporadic in the late nineteenth and early twentieth century. In the 1930s and 1940s research on hibernation and torpor notably picked up, however, largely due to the highly productive and insightful work of Martin Eisentraut, Paavo Suomalainen, and Charles Kayser. Research in the field gained even more momentum in the late 1940s and 1950s when these early pioneers were joined by other physiologists, such as Charles P. Lyman, Peter Morrison, Edgar Folk, or Felix Strumwasser, to name but a few. It was only logical then, that all leading researchers in the field as well as “newcomers” (such as George A. Bartholomew who had started to study dormancy only a few years earlier) and graduate students (e.g., Michael Menaker who received his Ph.D. later in the same year) would present and discuss their work during the “First International Symposium on Natural Mammalian Hibernation” which was held at Massachusetts Institute of Technology’s Endicott House in Dedham, Mass., from May 13–15, 1959.

Since 1959, International Hibernation Symposia were held at 3–5 year intervals at changing locations throughout the world. This book contains the proceedings of the 14th International Hibernation Symposium, held from August 9–13, 2012 in Semmering, Austria. The peer-reviewed chapters of this book provide a

comprehensive overview over the current state of research on not only torpor and hibernation, but seasonal adaptations of animals in general. This broadening of topics reflects a general trend in this conference series. Whereas the first symposium in 1959 was largely dedicated to hibernation, subsequent meetings have continuously increased the scope, and included other aspects of energetics and thermoregulation, biochemical mechanisms, endogenous clocks, signal processing, life-history tactics and further ecological topics. As in the present book, the range of animal models studied was also extended to include not just mammalian species, but also birds, reptiles, and invertebrates.

Due to this steady extension of topics, the title “Mammalian Hibernation” eventually seemed too narrow. Hence, starting with the 7th symposium in 1985, the name of the meeting and the book series was changed to “Living (or Life) in the Cold”. As pointed out by the editors of the previous book in this series (the proceedings of the 13th International Hibernation Symposium), this title was however somewhat unfortunate, as it implies a restriction to adaptations of animals exposed to cold temperatures in temperate or arctic climates. This would be misleading, as even the nineteenth century naturalists, such as Darwin, were already well aware that there are numerous tropical animals that display seasonal adjustments of morphology, behaviour and physiology, including states of dormancy. Therefore, the name “Life in the Cold” was given up in 2008, at the first meeting of this series held on the African continent.

The title of this book is “Living in a seasonal world: thermoregulatory and metabolic adaptations”. The term “seasonal” is by no means meant to refer only to the “four” seasons in temperate or polar regions, which are governed by changes in the amount of sunlight that reaches the Earth’s surface, and hence in temperature and photoperiod. It also includes the alternation between wet and dry periods in tropical and subtropical regions, temporal changes in food and water availability due to various reasons, and even irregular, unpredictable fluctuations of the environment. This book, as well as the previous books in the series, describes and discusses the fascinating adaptations of animals to all of the above facets of seasonality. It is this continuous physiological response to changing environmental conditions—a phenomenon called “rheostasis” by Nicholas Mrosovsky, another regular contributor to this symposium series—which is at the core of the proceedings summarized here.

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