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EDITORIAL

The many, exciting sequels to the story of fat

Raul K. Suarez[1,*] and Hans H. Hoppeler[2]

For a long time, adipose tissue has been known as either a storage site for lipid fuel or a site for thermogenesis. Adipocyte functions and their regulation are often thought of as scientific stories with familiar, happy endings. To many, fat has become a boring subject. But, as is often the case, these scientific stories are far from ended. Over the past two decades, exciting and fundamentally important discoveries have been made concerning the endocrine functions of adipose tissue, their roles in the control of dietary energy intake and their influence on the metabolism of other tissues. More kinds of adipocytes have been identified, and their ontogenetic origins and metabolic functions have been investigated. Just as some scientists proclaimed that the study of metabolism was a thing of the past, the global epidemic of metabolic diseases revealed how much was really not known; metabolism became interesting again. The metabolic interactions between adipose and other tissues, the chemical mediators they produce, and the roles these play when energy homeostasis is maintained or becomes dysregulated have become central questions in biomedical research. But questions of this nature – the regulation of synthesis, storage and breakdown of lipids, the roles played by adipose tissue in thermogenesis, thermoregulation, migration, prolonged fasting and hibernation – have been the focus of much research in comparative physiology for decades.

This special issue of JEB combines papers from comparative physiologists and biomedical researchers on various aspects of the 'biology' of fat. They are the new and exciting sequels to the stories with which we are all familiar and will take readers in a number of different directions. Some deal with our current knowledge regarding where and what kinds of adipocytes are deposited and what roles they might play. There are more types of adipocytes than previously thought and possibly even more than currently accepted. There are unusual (not well-known) lipids with functions still being deciphered in overwintering insects and diving mammals. Current research indicates that subcutaneous adipocytes are beneficial while abdominal adipocytes are implicated in metabolic disease. Fat can be exercise trained, and the training effects can be transferred from one individual to another through transplantation. The power of genetic techniques, applied to *Drosophila* and mammalian hibernators, is yielding insights of great value to comparative physiologists as well as biomedical scientists. Adipogenesis and lipid composition are being actively investigated in fish, in some species because they serve as genetically tractable models, and in others because of the importance of understanding the influence of dietary fat on body fat composition. Impressive feats of long-distance migration in birds are made possible through premigratory storage and in-flight catabolism of fats. While hummingbirds ingest large amounts of sugar, converting what they don't oxidize to fat for fueling migratory flight, excess sugar consumption can have highly detrimental effects on human metabolism and lead to the development of metabolic diseases. It is perhaps fitting to end this sample of story sequels by mentioning an entirely novel hypothesis: that there is not one, but two, evolved set points for the regulation of body fat content: a higher one responsive to the risk of predation and a lower one responsive to the risk of starvation.

We invite readers to explore these recent developments in the biology of fat.

[1]JEB Editor at Department of Zoology, University of British Columbia, #4200-6270 University Blvd, Vancouver, BC, Canada V6T 1Z4. [2]JEB Editor-in-Chief at Institute of Anatomy, University of Bern, Baltzerstrasse 2, CH-3000 Bern 9, Switzerland.

*Author for correspondence (rksuarez@zoology.ubc.ca)

R.K.S., 0000-0002-5530-9289; H.H.H., 0000-0003-0417-3091