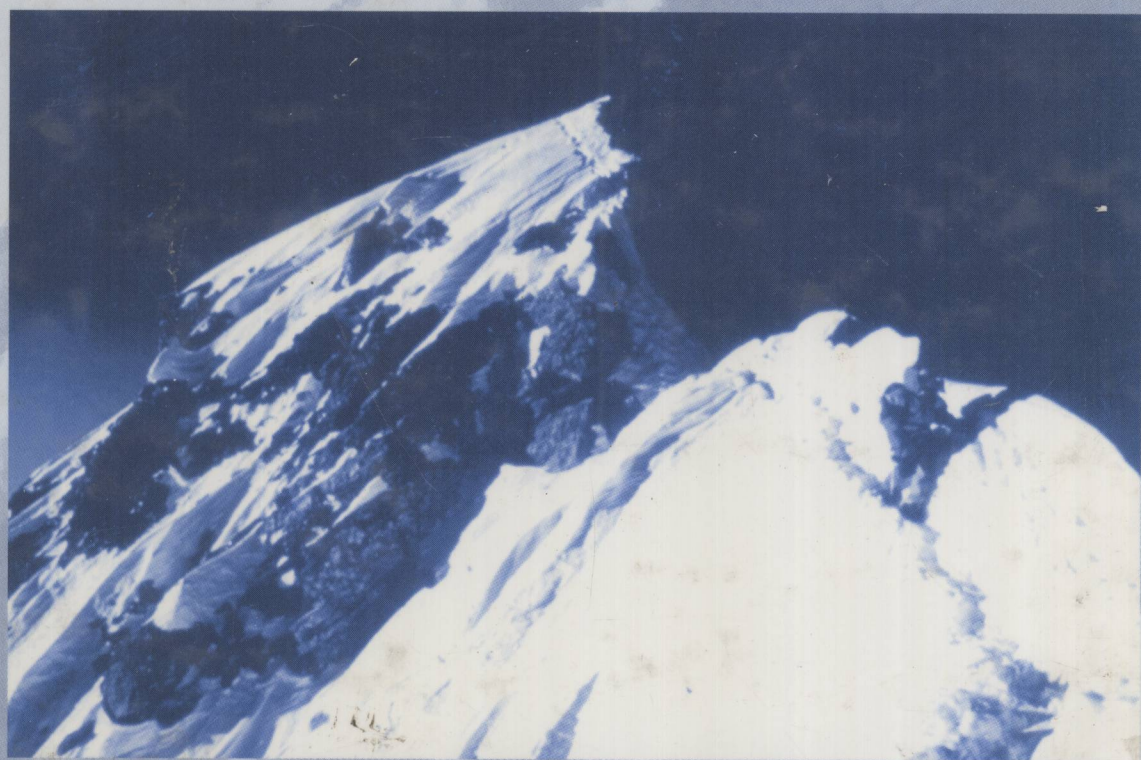


# FOOD INTAKE AND ENERGY EXPENDITURE



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Harry R. Kissileff

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*To the memory of Eliot Stellar 1920–1993*



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# Preface

*Food Intake and Energy Expenditure* has been developed for a course taught by the Open University of the Netherlands. We have tried to incorporate feedback from students and teachers, to produce a textbook that not only covers current courses in human nutrition, but also conveys a flavor of current research and an integrated approach to understanding food intake and energy expenditure.

This textbook is concerned with the relationship between the consumption of food by humans, and some other animals, and its utilization by the body, in various ways.

This idea is realized in four different parts, each with its own character.

*Food Intake and Energy Expenditure* is an integrated collection of essays on current problems in the field of ingestive behavior. Its strength and uniqueness lie in the selection of topics brought together under one cover by a group of authors who understand the importance of an interdisciplinary approach to the problem of energy cycling at the level of the individual animal or human subject. A complete understanding of this problem involves not only behavioral and metabolic processes occurring in the experimental subject as a whole, but also in the processes occurring at two distant ends of the organismic axis, i.e., the cellular/molecular coupled with the evolutionary. Because behavior of individual subjects frequently occurs in a social and environmental milieu, the special problems of studying food intake and energy expenditure in a social context and customary environment are incorporated.

Although topics in the individual chapters enable the reader/student to pursue a particular area in depth the editors have shown the interconnections among them so vital for a full understanding of the problems. Thus complete study of this book can provide the basis for a course on the regulation of energy balance that would be appropriate to a number of disciplines, such as biology, physiology, psychology, and nutrition.

This book is divided into four sections: psychobiology of ingestion, body weight regulation, energy expenditure, and evolution. Human and animal studies often treated separately in other contexts are integrated in the present context so that the application of animal studies to the human condition can be readily seen.

The emphasis in part I is on human eating behavior, and is unique in its conceptualization of analysis of behavior as an input-output system. Rather than summarizing debates about the use of psychological constructs, the approach is focused on the precise manipulation of quantifiable influences, such as variations in composition of a food stuff or gastric wall tension, on measurable behavioral outcomes such as reports of subjective feelings or amounts consumed. The criterion of precision is the ability of the manipulated input to predict the measured output. In the field of ingestive behavioral analysis, this approach represents a paradigmatic shift away from verbal explanation by means of constructs and intervening variables such as hunger, satiety, and palatability to residual variability in functional relational relationships and just noticeable differences. Adoption of this new approach will revolutionize thinking in this discipline.

The approach is based on the fundamental idea that energy input is matched to energy

output so that manipulations in energy density of a diet or administration of energy before a meal ought to be compensated by change in voluntary consumption.

The theme of energy balance is continued in part II, but the emphasis is focused more on the animal than the human with body weight considered as a regulated variable in a system where energy input and output are controlled to conserve body weight. Aberrations in body weight and extrapolation back to disturbances in human body weight regulation and ingestive disorders such as bulimia nervosa and anorexia nervosa link parts I and II.

In part III the focus is primarily on the expenditure side of the energy balance equation, but the role of food intake on energy expenditure draws connections back to parts I and II. Because energy output is continuous while input is periodic, the issue of the time frame for their integration receives critical attention, and temporal patterns of ingestion and expenditure are carefully considered. The utilization of nutrients for both growth and locomotion links this section back to the selection of diets and its effects on behavior discussed in parts I and II.

Finally in part IV, the longer term effects of natural selection which adapt an organism to its niche are considered from the standpoint of how such effects would be incorporated into a genome and modified by means of biochemical effects expressed through the endocrine system. The involvement of energy balance in the control of reproduction is a key issue in this context. The relationship between food intake and evolution is reflected in the size of natural populations in the long term, as an ultimate effect of feeding throughout life over several generations.

*Food Intake and Energy Expenditure* represents four different research lines, clearly separated into the four different parts of the book, in a way that research findings, conclusions, interpretations and discussions are translated into education, with different views on the same topics. We believe this approach to be more valuable and more direct for students, rather than the more traditional method of teaching concepts and facts.

Usually, the four different parts are taught separately, and often by separate departments. In this book not only the significance of the psychobiology of food intake for the physiology of food intake regulation is discussed, but also the implications of the physiological aspects for the psychobiological approach come into focus. Secondly, the regulation of body weight is not only highlighted from food intake regulation, but the important role of energy expenditure is taken into account. Thirdly, we not only discuss body weight regulation in the short term (days, weeks or months) but also the longer term evolutionary implications. An endocrinological approach, as well as an approach from the field of animal ecology allow us the possibility of translating short-term or proximate functions into long-term or ultimate functions.

This book is suitable not only for intermediate students in biological, behavioral, and nutritional sciences, but will provide advanced investigators in each of these fields with insights into linkages with the others. Because the emphasis is on a selection of current research problems rather than a global historical review of the energy balance as whole, it opens up challenging questions and will be fruitful in providing suggestions for interdisciplinary research.

Harry Kissileff  
Margriet Westerterp

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