

# Interdisciplinary Approaches to Food Digestion

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Editors

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 Springer

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# Foreword

Better human nutrition is now openly declared as one of the United Nation's Development Goals. Specifically, the objectives are "To promote healthy food systems and increase the focus on nutrition, with multiple implications for diet quality, vulnerable groups, and informed choice". We now see the rise of the obesity epidemic in all nations, even to the point where overweight parents can have stunted children. At the same time, and in different locations, macronutrient levels remain critically low in some diets.

Historically, the digestive tract has been regarded as a "black box", where the inputs are dietary components providing calories and essential nutrients whose levels can be calculated from chemical analysis of individual food inputs. The outputs are measured by various biological criteria such as weight gain, metabolites and markers in blood, urine and faeces. To achieve the new objectives, the mechanisms within the "black box" of individual human subjects will need to be identified and modelled. This is not easy, since unlike most man-made processing equipment, the human alimentary canal cannot be disassembled into its separate unit operations, and each one is likely to be different, because of individual genotype and phenotype and any and all dietary history.

This book presents a review of what we know and how we can plan to fill in the gaps by future research. One thing is for sure, the challenge is enormous and cannot be solved by the application of any one discipline.

While the development of high-throughput "metabolomics" is providing information at a massive scale and rate, the engineering approach to the digestive tract as a series of bioreactors and the physical tools to measure (non-invasively) the processes in real time add focus to the mechanism themselves. Furthermore, the material science of food is clarifying the origins of bioavailability, relating to its microstructure, and also identifying the taste and texture stimuli which cause us to prefer types of foods and choose a diet which is not always in the best interests of our long-term health. Evolution has driven the development of a digestive system that is highly effective at maximising nutrient intake and absorption from a limited supply of poor-quality food. In an environment of highly available food and nutrients, this is causing health problems. Social sciences also remind us that food is part

of everyone's culture. What we choose to eat is not simply determined by our individual nutritional requirements. Our choices of diet are strongly linked to our personal culture and environment.

The challenge is enormous, but as this volume shows, so are the opportunities to obtain evidence-based solutions. This is a fast-moving area of scientific enquiry. This book represents the state of the art but will probably need a second edition within 5 years.

Birmingham, UK

Peter Lillford

# Preface

Some of the questions this book aims to address are:

How can we quantify food digestion and what tools are available for measuring it?

Why are digestive processes so complex to understand and model?

What is the relevance in designing foods with specific behaviour during digestion?

Over the last two decades, there has been an increasing demand for foods that deliver specific nutritional benefits. In addition, the dramatic increase of food-related non-communicable diseases (e.g. obesity) requires development of novel food products that control satiety, glycaemic response, etc. Overall, digestion studies have gained increasing attention in recent years, especially as the link between diet and health/wellbeing becomes more evident. However, the link between digestion and health is complex, process involving a wide range of disciplines, including medicine, nutrition, chemistry, materials science and engineering. While a significant body of work exists within each discipline, there is a lack of a multidisciplinary approach to the topic, capable of providing a more holistic view of the process. To this end, a platform that brings together expertise to study how foods are disintegrated during digestion is the INFOGEST network (initiated in 2011 by COST FA 1005).

This book describes a *multidisciplinary* approach to food digestion studies. We first put food digestion in context presenting relevant phenomena, challenges and limitations in different approaches. We then focus on *quantification* studies aiming to describe food digestion and tools that are available for this quantification. A *case study* further puts theoretical knowledge in context and demonstrates ways digestion studies can be used to develop food products. Overall, we aim to produce a helpful companion and a reference book to a diverse audience throughout their journey in understanding digestion.

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