Flavour

EDITORIAL Open Access

# Gastrophysics—do we need it?

Ole G Mouritsen[1*] and Jens Risbo[2]

**Abstract**

Applying science, scientific reasoning, and scientific methodologies to the study of food and cooking is an old trait that to a large extent is based on the chemical sciences. The focus has been on chemical compounds as well as chemical reactions and transformations involved in foodstuff, preparation techniques, and culinary precision. Gastrophysics is proposed as a generic term to characterize an emerging scientific discipline primarily based on the physical sciences underpinned by all three pillars of modern physics: theory, experiment, and modeling/simulation. Gastrophysics takes its inspiration from the world of cooking and gastronomy. It is our contention that gastrophysics is a science in its own right, not a discipline designed only to service chefs in interpreting and creating new dishes. Gastrophysics is physics, and its empirical basis of gastrophysics is gastronomy itself.

## Physics or stamp collecting?

The British physicist Ernest Rutherford is quoted to have said 'All science is either physics or stamp collection.' A bold statement from a physicist, but probably meaningful in the sense that the history of physics is to have gone repeatedly into other disciplines and made them into modern, quantitative, and universal sciences—basically turning them into physics. Chemical physics, biophysics, geophysics, astrophysics, and econophysics are prominent examples. Hence, we suggest taking Rutherford's words as an invitation rather than an insult.

A recent international symposium entitled 'The Emerging Science of Gastrophysics' rallied a number of representatives of the physical, chemical, nutritional, psychological, and cognitive sciences as well as chefs, gastronomical entrepreneurs, and individuals working within gastronomical innovation. By bringing together key actors, the purpose of the Symposium was to help define, shape, and refine the preliminary and somewhat loose idea of gastrophysics. The Symposium concluded that gastrophysics, by its designated move from stamp collection to physics, could well have a significant impact on both gastronomy and tomorrow's food sciences and how they develop in the 21st century.

In this special issue of *Flavour*, thirteen scientists present nine 'statements' on gastrophysics and expose their personal opinion on what gastrophysics may be and whether we need this new term at all.

## Molecular gastronomy, molecular cuisine, culinary chemistry, culinary precision, note-by-note cuisine . . . and all that

Very strong opinions have been put forward regarding differences and similarities between all these terms. This is not the place to flog that old horse. Clearly, molecular gastronomy relies heavily on well-established sciences, such as food chemistry, general food science, and food processing technology. In their authoritative review on molecular gastronomy, Barham and colleagues [1] present their definition of molecular gastronomy and how it differs from gastronomy, advocating that molecular gastronomy 'should be considered as the scientific study of why some food tastes terrible, some is mediocre, some good, and occasionally some absolutely delicious.' In this definition there is no specific reference as to why the term molecular is invoked, although it is tacitly assumed that molecular gastronomy is based on a scientific and systematic study using molecularly based sciences, whereas nutrition and health are subdominant.

The use of physical principles to study foods from a materials science perspective is well established in food physics and food biophysics [2-4] with a focus on physical and physico-chemical properties, such as texture, foam stability, emulsification properties, phase transformations, the physical principles underlying cooking processes, and so on. These approaches are often less concerned with sensory perception and gastronomical

* Correspondence: ogm@memphys.sdu.dk
[1]Department of Physics, Chemistry, and Pharmacy, MEMPHYS, Center for Biomembrane Physics, University of Southern Denmark, Campusvej 55, Odense M DK-5230, Denmark
Full list of author information is available at the end of the article

considerations. McGee's encyclopedic monograph *On Food and Cooking: The Science and Lore of the Kitchen* [5] and Myhrvold's books on the *Modernist Cuisine* [6] are to date the most comprehensive accounts of the physical aspects of food and cooking (among other things) although these books are not claimed to be works of physics or gastrophysics. In fact, very little is written about gastrophysics from a scientific perspective and there appear to be only a few published scientific papers using the term gastrophysics [7,8].

## What is gastrophysics good for?

Seen from the point of view of physics, the empirical world of cooking and gastronomy is a new promising territory for the application of state-of-the-art concepts and methodologies from the physical sciences. Gastrophysics may not only transform our study of this empirical world into new science but at the same time it may revitalize the physics of the kind of soft matter that foodstuff is made of. Gastronomy could well be a source of inspiration for posing new and interesting physics problems.

Seen from the point of view of gastronomy, gastrophysics may potentially lead to new fundamental insights that can be translated into a more scientifically inspired approach to gastronomy, without removing any of the craft, creativity, and art so characteristic of cooking.

In the same way as biology provides a focusing lens for the field of biophysics, gastronomy becomes the source of inspiration for gastrophysics. In particular, gastrophysics aims to exploit, on all relevant time- and length-scales, recent advances in the physical sciences to advance the scientific study of food, the raw materials, the effects of processing food, and quantitative aspects of the physical basis for food quality, flavor, appreciation and adsorption in the human body.

With a focus on fundamentals and universal phenomena, rather than nitty-gritty details and 'stamp collection', gastrophysics may become to gastronomy what astrophysics has come to be for astronomy.

**Competing interests**
The authors declare that they have no competing interests.

**Acknowledgements**
The authors wish to thank all speakers and participants at the International Symposium on 'The Emerging Science of Gastrophysics' for their enthusiasm, criticism, and constructive discussions on all aspects of science, cooking, and gastronomy.

**Author details**
[1]Department of Physics, Chemistry, and Pharmacy, MEMPHYS, Center for Biomembrane Physics, University of Southern Denmark, Campusvej 55, Odense M DK-5230, Denmark. [2]Department of Food Science, University of Copenhagen, Rolighedsvej 30, Frederiksberg C DK-1958, Denmark.

Received: 16 November 2012 Accepted: 16 November 2012
Published: 9 January 2013

**References**

1. Barham P, Skibsted LH, Bredie WLP, Bom Frøst M, Møller P, Risbo J, Snitkjær P, Mørch Mortensen LM: **Molecular gastronomy: a new emerging scientific discipline.** *Chem Rev* 2010, **110:**2313–2365.
2. Barham P: *The Science of Cooking*. Heidelberg: Springer; 2001.
3. Vega C, Ubbink J, van der Linden E: *The Kitchen as Laboratory. Reflections on the Science of Food and Cooking*. New York: Columbia University Press; 2012.
4. Vilgis T: *Das Molekül-Menü*. Stuttgart: Hirzel; 2011.
5. McGee H: *On Food and Cooking: The Science and Lore of the Kitchen. Revised edition*. New York: Scribner; 2004.
6. Myhrvold N, Young C, Bilet M: *Modernist Cuisine: The Art and Science of Cooking*, Volume 6 volumes. Bellevue, WA: The Cooking Lab; 2011.
7. Parkers K: **Recipe for success: teachers get inspiration from 'gastrophysics'.** *Phys Edu* 2004, **39:**19.
8. Mouritsen OG: **The emerging science of gastrophysics and its application to the algal cuisine.** *Flavour* 2012, **1:**6.

doi:10.1186/2044-7248-2-3
**Cite this article as:** Mouritsen and Risbo: Gastrophysics—do we need it?. *Flavour* 2013 **2**:3.