DIFFERENTIATION AND INTEGRATION IN NATURAL SCIENCE, IMPORTANCE OF FOOD PHYSICS, AS A PART OF FOOD SCIENCE AND APPLIED PHYSICS

A. S. Szabo, P. Laszlo

Food Physics Public Utility Foundation,
Szent Istvan University,
Faculty of Food Science

andras.szabo@uni-corvinus.hu

Keywords:

applied physics,
food physics a bridge,
development of food physics,
interdisciplinary food physics,

Abstract. The development and modification of the science, forming and establishment of new fields is a normal process, carried out in general by 2 ways: differentiation and integration. This trend of development is typical for the segments of natural science, as well, including e.g. physics, chemistry, biology.
Analysing some special fields of natural science the paper tries to find true answers to the following questions:

- what are the dominant parts of food science and applied physics?
- is food physics a bridge between applied physics and food science?
- what are the factors, influencing the development of food physics?
- is food physics an interdisciplinary sub science?
- what are the development trends of food physics (Quo Vadis Cibus Physicorum)?

DIFFERENTIATION AND INTEGRATION

Figure 1. shows the process of differentiation and integration in physics.

Differentiation in classical physics:

- mechanics (statics, dynamics)
- optics
- acoustics
- electricity and magnetism
- hydrodynamics
- aerodynamics
- astrophysics
- nuclear physics
- statistical physics

Differentiation in modern physics:

- quantum mechanics
- wave mechanics
- particle physics (e.g. neutron physics)
- solid state physics
- high energy (speed) physics
- cosmic physics
- atomic (nuclear) physics
- reactor physics
- laser physics

J. Food Physics, 2015/2016, Vol.28-29, pp.9-13.

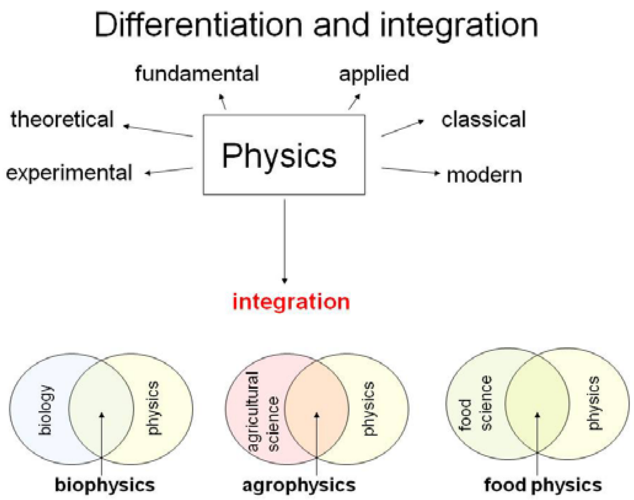

Figure 1
Process of differentiation and integration in physics.

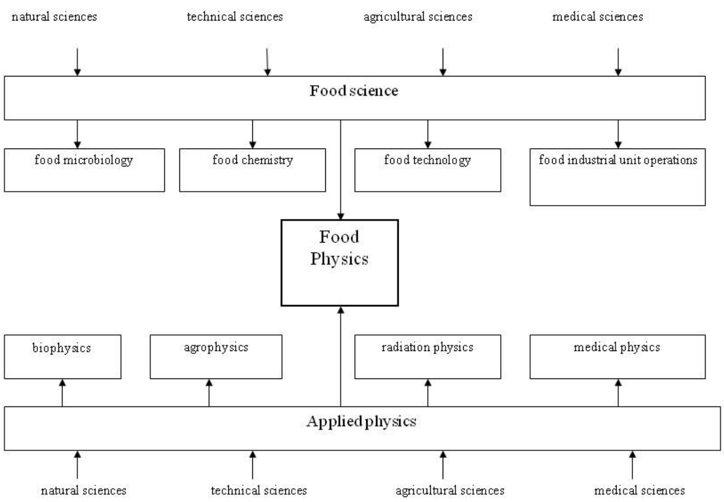

Figure 2
The food physics as a bridge between food science and applied physics

FOOD PHYSICS AS A BRIDGE

Figure 2. shows the food physics as a bridge between food science and applied physics.
3 main topics of food physics:

- physical parameters of foodstuffs
- physical methods for investigation of foodstuffs
- physical methods for treatment and processing of foodstuffs

INTERDISCIPLINARY SCIENCES AND SOME OTHER FIELDS OF APPLIED PHYSICS

The term „food physics" is not known enough in spite of the fact, that the constituent words (food and physics) have been used for thousands of years in the history of mankind. Food physics is a part of applied physics, but belongs to the food sciences, as well.

Food physics is a new field of science, rather special, but typically interdisciplinary science. If we use the term in wider interpretation, food physics will cover a significant part of the R+D activity of food industry, because the base of measurement techniques, mechanisation, instrumentation, automation, regulation, control and even robot-techniques is the same: physics.

Food physics deals with the physical properties of food, food ingredients and their measurement. Physical properties of food play a key role in all fields where modern technological processes are applied for the generation of food raw materials and the production and processing of food.

The determination of physical properties of food and related products is a requisite for planning, production engineering and automation processes in today's food industry, as well as in quality control activities.

Some other fields of applied physics:

- soil physics
- geophysics
- atmosphere physics
- climate physics
- chemical physics
- polimer physics
- radiation physics
- medical physics
- biophysics

TRENDS IN THE DEVELOPEMENT OF FOOD PHYSICS (QUO VADIS CIBUS PHYSICORUM?)

Figure 3. shows the technology hill.
Radiation methods and techniques in the agro-food sector:

- Ionizing radiation techniques and technologies (gamma-sources, X-ray equipments, accelerators, reactors)
- Non-ionizing radiation techniques (light-technique, IR, UV, Laser, SYNERGOLUX: UV+ozone, polarized light)
- Radiostimulation
- Radiomutation
- Food and feed irradiation
- Isotope techniques, tracer techniques
- Radio-analytical techniques (e. g. AA, XRF)
- Measurement techniques (quantity, level, thickness etc.)
- Radiometrical control of the food chain
- Radioecological measurements

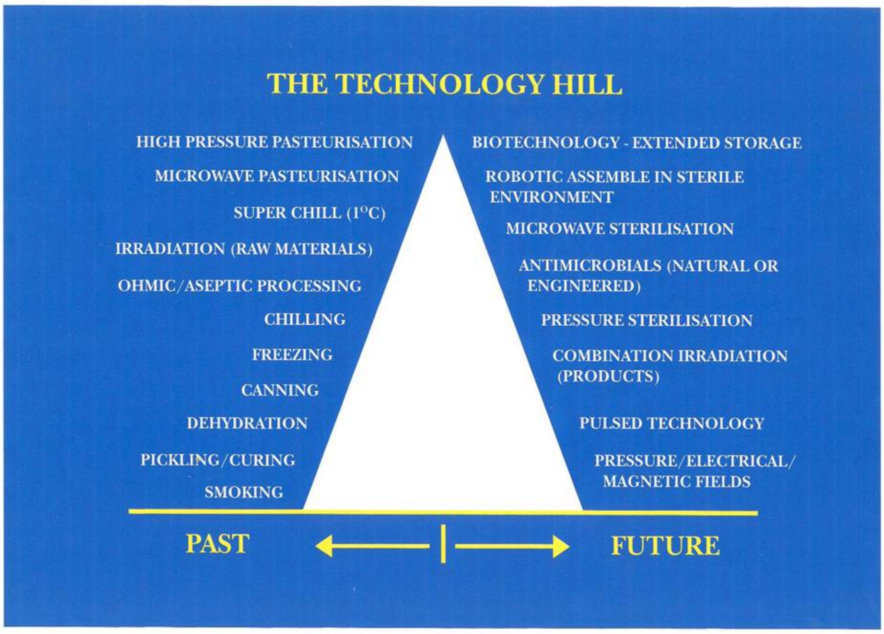

Figure 2
The technology hill

Nondesctructive measurement techniques:

- NIR-NIT spectrometry for determination of main components
- NMR techniques for rapid fat /oil measurements
- INAA techniques for determination of elements
- DSC method for study of different processes in foodstuffs (e.g. heat denaturation of proteins)
- XRF techniques for measurement of elements
- Rheometry (viscosimetry, plasto-metry, penetrometry, fructometry) for texture and consistence analysis

REFERENCES

A.S. Szabo: Radioecology and environmental protection. Ellis Horwood Ltd, Chichester, 1993.

A.S. Szabo: Food physics – new, hopefully developing field of food science. J. Food Physics, 103-110, 1994.

A.S. Szabo: Food science, food physics, radiation technique. Journal of Food Physics, supplement, 14-21, 1996.

A.S. Szabo: Food physics as an important part of food science and applied physics. Int. Agrophysics, 13, 407-409, 1999.

A.S. Szabo: Trends of development in food physics. J. Food Physics, 101-104, 2000/2003.

A.S. Szabo, J. Simon, P. Laszlo: The growing importance of aspects of food safety and food physics in the industrial food processing. J. Food Phys., 93-96, 2004/2005.

A.S. Szabo, P. Laszlo, J. Simon: The growing importance of aspects of food safety and food physics in the industrial food production. J. Food Phys., 6-8, 2006.

L.O. Figura, A.A. Teixeira: Food physics. Physical properties, measurement and applications. Springer Verlag, 2007, p. 550.

A.S. Szabo: Food safety and food physics – aspects in food processing and qualiy control. J. Food Physics, 21, 102-106. 2008.

A.S. Szabo, P. Laszlo: Food physics and food safety – someaspects in food reocessing and foodqualiy control. J. Life Scieces, 4(7), 58-60, 2010.

A.S. Szabo, P.Laszlo, P. Tolnay: Importance of food physics, to fulfill the expectations of modern food technologies. J. Food Science and Eng., 3, 169-175, 2013.

A.S. Szabo, P. Laszlo: Differentiation and integration in natural science, importance of food physics, as a part of food science and applied physics. XIIth Int. Conf. Food Phys., 6-8 July, 2016, Debrecen, book of abstracts, p. 10. (ed.: P. Sipos, I. Fekete).