

## Interconnected World – Interacting Sciences

Combine your computational and numerical skills with life sciences!

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**That is: BUILD BRIDGES! Go for an interdisciplinary PhD at a special place!**

You have probably never heard of DEBRECEN, the second biggest city in HUNGARY, with its 500 years old University of 27,000 students, among them 5000 foreign students, receiving graduate and post-graduate education in English. Click on <http://edu.unideb.hu/page.php?id=258> and you'll see the exciting environment waiting for you.

PhD opportunities are available in new, truly interdisciplinary areas, Predictive Food Microbiology and Computational Nutrition. Here you can get live experiences how to utilize your skills in

- Modelling in biosciences; Numerical mathematics; Parametric statistics; Optimisation; and
- Big data and its computational tools; Network science; Programming.

Scholarships are available on <http://studyinhungary.hu/study-in-hungary/menu/stipendium-hungaricum-scholarship-programme>. The Doctoral School is that of Nutrition and Food (Debrecen University, Hungary); the supervisor is József Baranyi (see his BIO below). The project descriptions are as follows:

### Project 1.

Bacterial kinetics in food are determined by the temperature and the food environment, primarily the pH and water availability. The effect of these factors on the population's maximum specific growth rate, its most important parameter, is commonly described by multivariate functions, that can be approximated by response surfaces over data available from such datasets as ComBase ([www.combase.cc](http://www.combase.cc)). The best structure of such empirical response surfaces is still not clarified. In this project a comprehensive numerical analysis will be carried out to answer the question, with special emphasis on the interaction between the parameters of those response surfaces, such as the cardinal values of the environmental factors, i.e. the minimum, maximum and optimum values in their growth regions.

This research will be conducted in close collaboration with Nestlé Research Center, Lausanne, Switzerland.

The ideal PhD candidate is an MSc in applied mathematics, physics, engineering, with a strong affinity to food/health-related life sciences or vice versa. To be able to work effectively with international collaborators, it is vital that that candidate possesses (or develop, by the start of the project) a good standard of English.

## Project 2. “Big Data” and computational nutrition for healthy diet

Health and nutrition are primarily linked in the context of the human genome and microbiome. The genome is a set of genes defining the immune system and the internal environment in the GIT (Gastro-Intestinal Track) where the microbes help to break down the food that we eat.

Both genome and microbiome have been increasingly researched by computational methods, data mining and bioinformatics. The key here is the recognition that, with the advent of “big data” (the explosion of observations stored electronically), new patterns emerge, challenging many previously rock-solid dogmas. These patterns can only be detected by advanced computational and statistical tools and this project is an example for the interdisciplinary science of computational nutrition.

A database will be built to find patterns between constantly evolving diets and the big three diseases characteristic of later life: cancer, cardiovascular diseases and dementia. Data from publications as well as internet databases will be browsed by a specifically created data-mining software tool (a “crawler”), and the results will be analysed and visualized by network science and statistical methods. The research will contribute to a related big programme, Foodome, (<https://www.barabasilab.com/projects>), of the world-renowned Barabási Lab, and will be carried out in collaboration with partners from medical and food sciences.

The ideal PhD candidate is an MSc in informatics with strong affinity to food/health-related life sciences or vice versa. To be able to work effectively with international collaborators, it is vital that that candidate possesses (or develop, by the start of the project) a good standard of English.

The calls are here:

[https://doktori.hu/index.php?menuid=195&lang=EN&tk\\_ID=170568](https://doktori.hu/index.php?menuid=195&lang=EN&tk_ID=170568)

For the other call, a mathematician, physicist with strong interest in life sciences; or a food- or bio-engineer with strong computational skills would be the best candidate:

[https://doktori.hu/index.php?menuid=195&lang=EN&tk\\_ID=170567](https://doktori.hu/index.php?menuid=195&lang=EN&tk_ID=170567)

**For both, the application deadline is 15th December.**

**Scholarship can be applied for, online, at this URL, with a deadline of 15 November:**

<http://studyinhungary.hu/study-in-hungary/menu/stipendium-hungaricum-scholarship-programme>



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*Doctor Honoris Causa and Privatdozent  
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József Baranyi is a Hungarian-British **mathematician**, who worked for the Institute of Food Research of the United Kingdom, for 26 years, leading the Computational Microbiology Research Group there. Currently he is a Scientific Advisor at the University of Debrecen, Hungary, a Visiting Professor at the Physics Department of Imperial College, London, UK, and a Privatdozent at the Szent-István University, Budapest, Hungary.

He has held more than 150 international workshops on mathematical modelling and statistics for life sciences. He was the Statistical Advisor of the Journal of Applied Microbiology for 14 years and a member of the Editorial Board of Applied and Environmental Microbiology for 15 years; currently he is a member of the Editorial Board of the International Journal of Food Microbiology. Developer and founding member of the ComBase system ([www.combase.cc](http://www.combase.cc)); authored or co-authored nearly 100 research papers, book chapters and other scientific communications, with a total citation of >5000 (Scopus, 2018). The Baranyi-model on bacterial growth is one of the most frequently quoted models in predictive microbiology.

He has been member of the scientific / organizing committee in numerous international conferences; has given several invited/keynote talks on international conferences. He is a Doctor Honoris Causa of the Szent-István University of Hungary, a recipient of the “Distinguished Service Award” of the American Society for Microbiology and an elected member of the International Academy of Food Science and Technology, the prime advisory body of the International Union of Food Science and Technology.