Development of predictive systems-level models in medical and industrial biotechnology

It is often said that biological systems, such as cells, are 'complex systems'. A popular notion of complex systems is of one of a very large number of simple and identical elements interacting to produce 'complex' behaviors. However, the reality of biological systems is somewhat different: large numbers of functionally diverse, and frequently multifunctional sets of elements interact selectively and nonlinearly to produce coherent rather than complex behaviors. To understand the complexity of biological systems, our group integrates experimental and computational research — in other words we apply a systems biology approach. Systems biology, through pragmatic modeling and theoretical exploration, provides a powerful foundation from which to address critical scientific questions head-on.

The main objective of our Systems biology and Bioinformatics (SBI) unit is to discover new molecular mechanisms using an iterative cycle that starts with experimental data, followed by data analysis and data integration to determine correlations between concentrations of molecules, and ends with the formulation of hypotheses concerning co- and inter-regulation of groups of those molecules. These hypotheses then predict new correlations, which can be tested in new rounds of experiments or by further biochemical analyses. The major strengths of our approach are that it is potentially complete (i.e. genome-wide) and that it addresses the genome, transcriptome, proteome, metabolome and fluxome. SBI works on addressing questions fundamental to our understanding of life, yet progress here will lead to practical innovations in medicine, drug discovery and bioengineering. SBI has two distinct branches: knowledge discovery, or data-mining, which extracts the hidden patterns from huge quantities of experimental data, forming hypotheses as a result; and simulation-based analysis, which tests hypotheses with in silico experiments, providing predictions to be tested by in vitro and in vivo studies.

SBI is the host of the junior research group “Fungal Informatics” headed by Dr Amelia Barber. The funds are provided by the Cluster of Excellence Balance of the Microverse (EXC 2051), that is funded in the frame of Germany’s Excellence Strategy.
Open positions

We are working on several exciting projects in the general area of systems biology and bioinformatics. Most of our projects are in collaboration with leading labs from US, Europe, and Asia. We are always looking for new individuals to join our group.

Specifically:
We are looking for highly motivated, hard working students at the Bachelor or Master level to work on high risk-high reward research projects. We are also interested for student-initiated, faculty-supervised projects that allow students to explore areas of their interest in depth. Send us your CV at gianni.panagiotou@leibniz-hki.de.

We are looking especially for new PhD students and Post Doctoral researchers with a solid background in any of the following areas: bioinformatics, genomics, computational biology, chemoinformatics, modelling of biological systems. However, if you are extremely good on something else we would be happy to hear about it and design projects together.