UNIVERSITÄT
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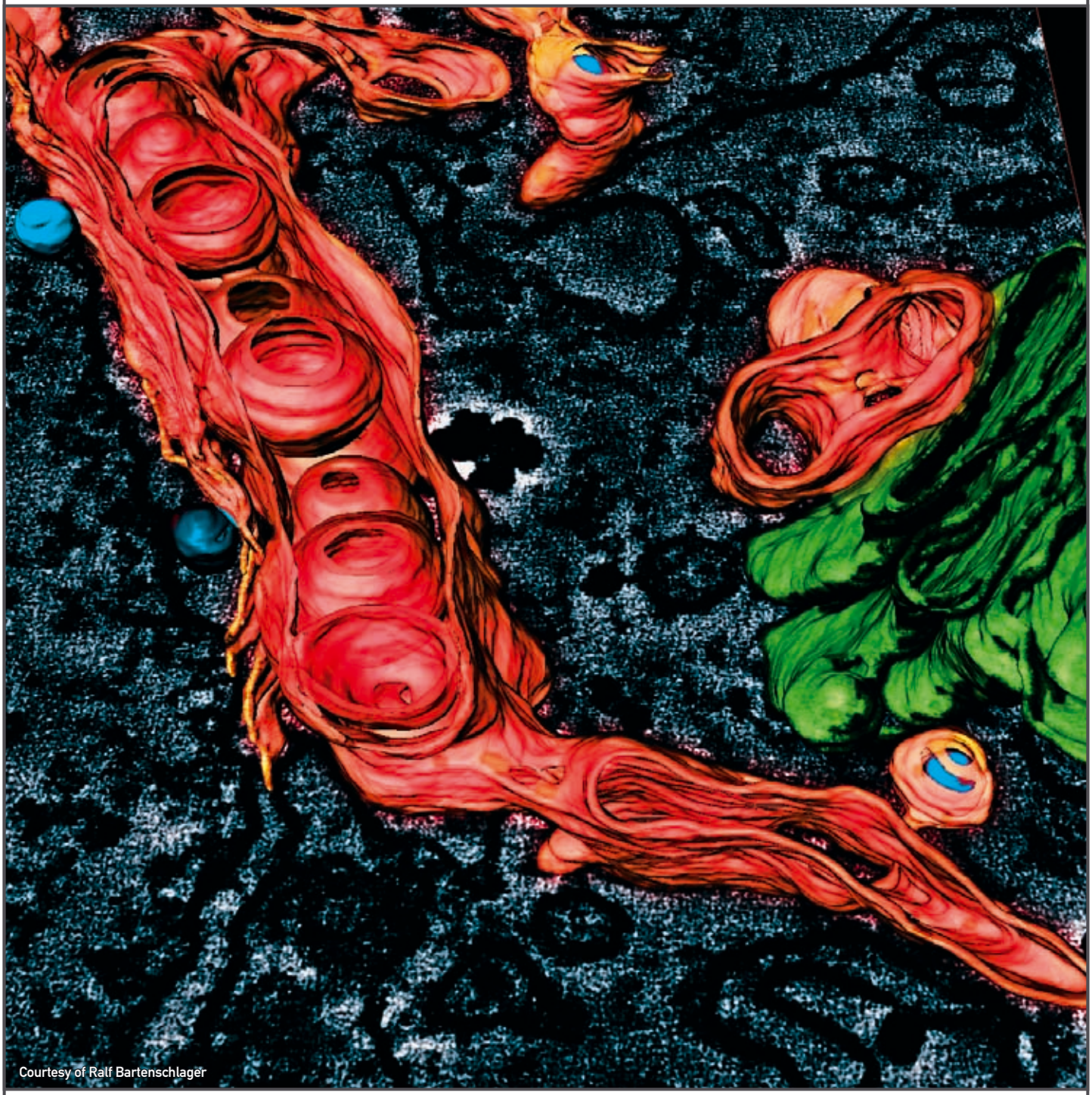
FORSYS – ViroQuant.

Systems Biology of Virus-Host Cell Interaction

ViroQuant



Courtesy of Ralf Bartenschlager

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FORSYS
Research Units for Systems Biology

FORSYS – ViroQuant. Comprehensive and Quantitative Characterization of Virus-Host Cell Interaction

Viruses are among the most important human pathogens, both in terms of global health and economy. Virus entry, replication and spread depend on various interactions between the virus and the host cell machinery. Within the German FORSYS initiative supported by the Federal Ministry of Education and Research the systems biology center **FORSYS-ViroQuant: Systems Biology of Virus-Host Cell Interaction** at Heidelberg University systematically and quantitatively investigates the complex cellular networks that are essential for viral infections. The research program focuses on the causative agents of AIDS (HIV), chronic liver disease (HCV), and cervical cancer (HPV) for which currently there are no effective therapies available. ViroQuant's model based approach will contribute to a quantitative and comprehensive understanding of the full infectious cycle of these viruses with far reaching implications for both basic research and medical application.

The ViroQuant consortium comprises more than 30 principal investigators from various research institutions such as the University of Heidelberg and the Medical Faculty and University hospital Heidelberg, the German Cancer Research Center, and the European Molecular Biology Laboratories. It represents a unique combination of expertise in the areas of virology, mathematical modeling and simulation, (bio)-informatics, high-content and high-throughput screening, high-resolution microscopy, image analysis, and management of large data sets.

To cope with the different aspects of this systems biological approach ViroQuant is divided into three major research areas, which are dedicated to the experimental sciences, to modeling and simulation and to technology development with an emphasize on image based methods and data processing.

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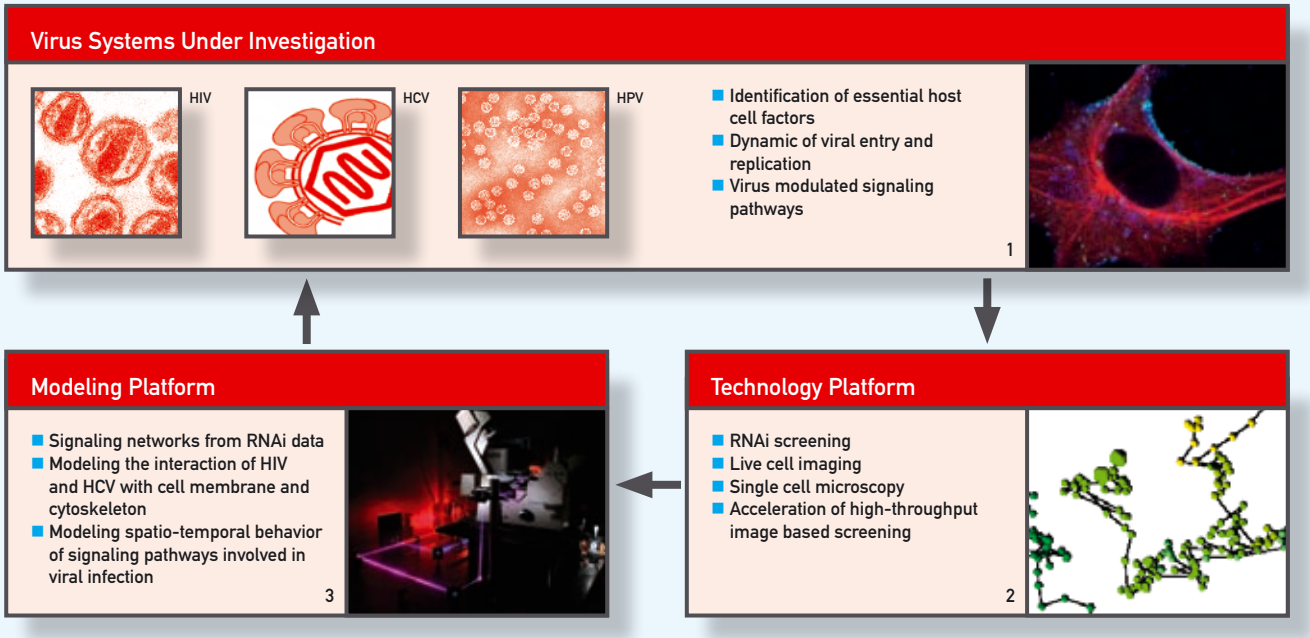
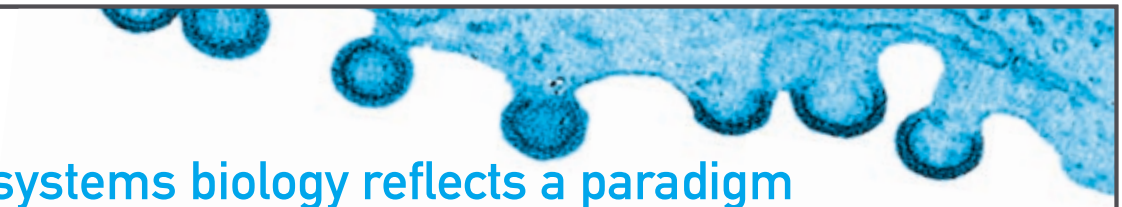
dkfz.

EMBL

FORSYS – ViroQuant: an Interdisciplinary Research Program



1: Courtesy of Maik Lehmann / 2: Courtesy of Roland Eils / 3: Courtesy of Dirk-Peter Herten

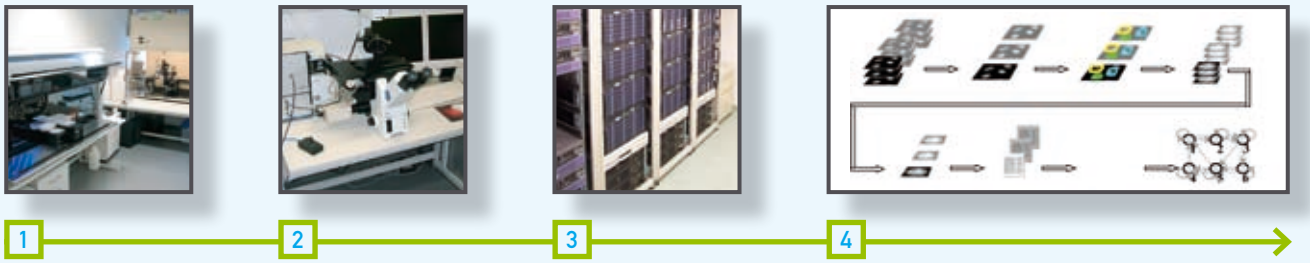


"The term systems biology reflects a paradigm shift in the life sciences with far reaching implications for both basic research and medical applications."

Roland Eils

ViroQuant Cellular Phenotyping Pipeline

High-throughput and high-content image acquisition, data storage and analysis



1 Liquid handling and slide production
2 Imaging (current acceleration by factor of 10)
3 Data management and storage
4 Data analysis and classification (current hardware acceleration on GPUs for feature extraction by factor of 19)

Teaching Program for Systems Biology

Besides its research goals ViroQuant is committed to implement a sustainable infrastructure for Systems Biology education (Bachelor, Master and PhD student level) at Heidelberg University.

In the framework of the international Master program Molecular Biosciences at Heidelberg University a new Major curriculum for Systems Biology has been established. The program covers fundamental topics in bioinformatics, computational analysis, network reconstruction, and dynamic pathway analysis as well as multi-scale modeling. According to the research expertise in Heidelberg, the biological systems to be presented focus on cellular systems with an emphasis on infectious diseases, cellular signaling, developmental biology, and cancer biology. Practical courses as well as the master thesis are performed in the framework of the research activities of the teaching faculty. Thus, from an early stage on students are integrated into relevant, ongoing research projects in systems biology. Most recently, an international student exchange program with the Universities of Amsterdam, Luxembourg, Manchester, Tokio Medical and Dental University was initiated.

New Major curriculum for Systems Biology at Heidelberg University

Fourth Semester (start SS 2010)	
Master's Thesis	6 months
Seminar "Progress in Systems Biology"	3 weeks
Third Semester (start WS 2009/10)	
"Working in Systems Biology 1" + Seminar	6 weeks
"Working in Systems Biology 2" + Seminar	6 weeks
Second Semester (start SS 2009)	
Lecture & Tutorial Systems Biology 1 "Systems Cell Biology"	5 weeks
Lecture & Tutorial Systems Biology 2 "Physio-chemical Methods in Systems Biology"	5 weeks
Lecture & Tutorial Systems Biology "Theoretical Systems Biology 1"	3 weeks
Lecture & Tutorial Systems Biology "Theoretical Systems Biology 2"	3 weeks
First Semester (start WS 2008/09)	
Lecture & Tutorial "Frontiers in Biology" (mandatory for masterstudents)	10 weeks
Practical courses & Seminar "Quantitative Biology"	3 weeks
Course & Tutorial "Computational Biology"	3 weeks

Scientific Coordinators

Prof. Dr. Roland Eils
Heidelberg University, BioQuant/Institute of Pharmacy and Molecular Biotechnology
German Cancer Research Center (DKFZ)

Prof. Dr. Jürgen Wolfrum
Heidelberg University, BioQuant/Institute of Physical Chemistry

ViroQuant

Center for Quantitative Analysis of Molecular and Cellular Biosystems

BioQuant
MODEL base of LIFE

FORSYS-ViroQuant is an integral part of **BioQuant,** the **Center for "Quantitative Analysis of Molecular and Cellular BioSystems"** at Heidelberg University. BioQuant was established in 2007 as an interdisciplinary University research center that is solely dedicated to research and training in systems biology. BioQuant's objective is to function as a platform for the development and constant refinement of mathematical models of complex biological systems as well as the swift validation of scientific hypotheses via experimental data. Currently, up to 40 University and non-University research groups (DKFZ, EMBL, the European Media Lab, and the MPI for Medical Research) are affiliated with BioQuant. These research groups are instrumental for numerous national and international systems biology funding initiatives including the FORSYS-ViroQuant, HepatoSys, SysMo, and several MedSys, SysTec, and GerontoSys networks, the public-private-partnership program BioMS as well as parts of the Helmholtz Initiative for Systems Biology (SBCancer), and the Excellence Cluster CellNetworks.

Besides advanced computational tools and methods for data analysis, image processing, and modelling, BioQuant's central technology platform provides cutting edge technologies for systematic functional imaging with an emphasize on high-throughput and high-content microscopy, high-resolution microscopy and electron microscopy (conventional and cryo EM). The NIKON Imaging Center (2) and the Hamamatsu TIGA (Tissue Imaging and Analysis) Center (3) are both integral parts of BioQuant's technology platform.

1: Courtesy of Dirk Altenkirch / 2: Courtesy of Markus Winter /
3: Courtesy of TIGA Center

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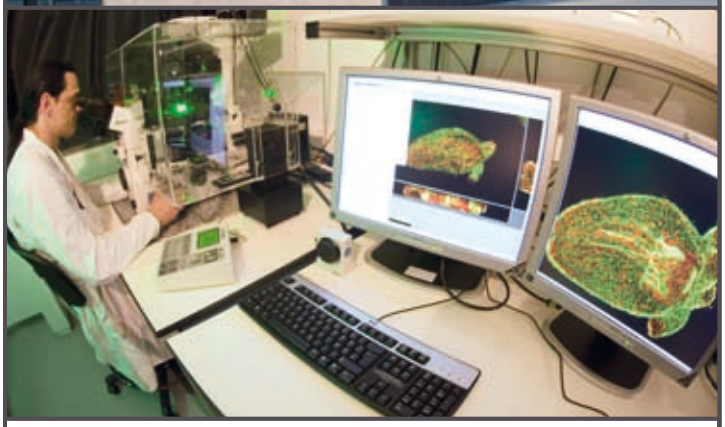
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