Systems Biomedicine in Luxembourg

Rudi Balling
Luxembourg Centre for Systems Biomedicine
http://wwwen.uni.lu/lcsb
FROM AGRICULTURE TO STEEL TO FINANCE TO HEALTH

1890

1990

2010

2013
The National Vision of Personalized Medicine

From Financial Banks…

to Biobanks…

Personalized Medicine Luxembourg
Building up Systems Biomedicine in Luxembourg

The LCSB on the Belval Campus
A Focus on Neurodegenerative diseases

Alzheimer
Parkinson
Huntington
ALS
Multiple Sclerosis
Pathways implicated in Parkinson disease
From cohorts to animal models – and back again

Familial Studies  Crosssectional Cohorts  Longitudinal Cohorts

Pathway and Network Analysis
Computational Models

Yeast  Zebrafish  Mouse  iPS
The Application of Stable Isotope Assisted Metabolomics in Biomedicine

André Wegner\textsuperscript{a}, Thekla Cordes\textsuperscript{b}, Alessandro Michelucci and Karsten Hiller\textsuperscript{c}

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Immune-responsive gene 1 protein links metabolism to immunity by catalyzing itaconic acid production

Alessandro Michelucci\textsuperscript{a}, Thekla Cordes\textsuperscript{b}, Jonny Ghelfi\textsuperscript{a}, Arnaud Pallot\textsuperscript{a}, Norbert Reiling\textsuperscript{a}, Oliver Goldmann\textsuperscript{a}, Tina Billa\textsuperscript{a}, André Wegner\textsuperscript{a}, Arvind Talled\textsuperscript{a}, Antonio Roussel\textsuperscript{a}, Manuel Buttini\textsuperscript{a}, Carole L. Linster\textsuperscript{a}, Eva Medina\textsuperscript{a}, Rudi Bollinger\textsuperscript{a}, and Karsten Hiller\textsuperscript{a,c}

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Edited by Philipp Murack, Howard Hughes Medical Institute, National Institutes of Health, Denver, CO, and approved March 31, 2013 (received for review October 24, 2012)
Functional validation and drug screening in Zebrafish

- Gain and loss of function mutants
- Live imaging
iPS-derived neural stem cells & dopaminergic neurons

Jens Schwamborn

STEM CELLS AND DEVELOPMENT
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ORIGINCAL RESEARCH REPORT

The Parkinson’s Disease-Associated LRRK2 Mutation R1441G Inhibits Neuronal Differentiation of Neural Stem Cells

Lamia’a Bahrassawy,1,9 Sarah Nicklas,1,9 Thomas Palm,1,9 Ingeborg Menzl,1,9 Fabian Birzele,4 Frank Gillardon,4 and Jens C. Schwamborn1,9

Pluripotent stem cells → Neuronal stem cells → Dopaminergic neurons
From cohorts to animal models – and back again

Pathway and Network Analysis
Computational Models

Familial Studies  Crosssectional Cohorts  Longitudinal Cohorts

Yeast  Zebrafish  Mouse  iPS
PathVar: analysis of gene and protein expression variance in cellular pathways using microarray data
Enrico Glaab\textsuperscript{1,2,*} and Reinhard Schneider\textsuperscript{1,2}
\textsuperscript{1}Structural and Computational Biology Unit, EMBL, Meyerhofstrasse 1, 69117, Heidelberg and \textsuperscript{2}Luxembourg Centre for Systems Biomedicine (LCSB), University of Luxembourg, Luxembourg, Germany
Associate Editor: Martin Bishop

EnrichNet: network-based gene set enrichment analysis
Enrico Glaab\textsuperscript{1,*}, Anaïs Baudot\textsuperscript{2,\textsuperscript{*}}, Natalio Krasnogor\textsuperscript{3,\textsuperscript{†}}, Reinhard Schneider\textsuperscript{1,\textsuperscript{†}} and Alfonso Valencia\textsuperscript{4,\textsuperscript{†}}
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\textsuperscript{3}Interdisciplinary Computing and Complex Systems (ICOS) Research Group, University of Nottingham, NG8 1BB Nottingham, UK
\textsuperscript{4}Structural Biology and Biocomputing Program, CNIO, E-28029 Madrid, Spain
Kinetic models of mitochondrial dysfunction
A community-driven global reconstruction of human metabolism

A community driven Parkinson disease map

http://minerva.uni.lu/pd_map/

- Literature and expertise-based curation
- Map annotation
- Network analysis
- Text mining-based map enrichment
- Integration of sequencing data with map
**LCSB European Grants**

- eTRIKS (IMI) - European Translational and Knowledge Services
- Aetionomy (IMI) - Mechanisms based Aetiology of Neurodegenerative Diseases
- BIOMARK-AD (JPND) - Alzheimer and Parkinson Biomarkers
- Courage-PD (JPND) - Comprehensive unbiased risk factor assessment for genetics and environment in PD
- CoGIE (ESF) - Consortium on the Genetics of Idiopathic Epilepsy
- EpiPGX (EU-7.FW) - Epilepsy Pharmacogenomics
- CaSym (EU-7. FW) - Concerted Action in Systems Medicine
- BioCog (EU-7. FW) - Biomarker Development for Postoperative Cognitive Impairment in the Elderly

**Total Grants by LCSB 2009-2013: > 20 Mio. €**
In preparation: A National Centre of Excellence in Research

Duration: 8 + 4 years
Funding: 16 + 8 Mio $