

**Advanced Lecture Course on Systems Biology**  
sponsored by SystemsX.ch, BMBF and ERASysAPP  
March 2 - 8, 2014, Hotel Grauer Bär\*\*\*\*, Innsbruck, Austria

### **SysBio2014 Organizers**

**Uwe Sauer** (ETH Zürich, CH)  
**Edda Klipp** (Humboldt University Berlin, DE)  
**Ursula Kummer** (University of Heidelberg, DE)  
**Wolfgang Müller** (University of Heidelberg, DE)  
**Hans Westerhoff** (VU University Amsterdam, The University of Manchester, NL/UK)  
**Karl Kuchler** (Medical University Vienna, AT)

### **SysBio2014 Course Office Vienna**

**Regina Klaus**  
Medical University Vienna  
Max F. Perutz Laboratories  
Department of Medical Biochemistry  
Dr. Bohr-Gasse 9/2  
A-1030 Vienna, Austria  
T: +43-1-4277-61801 F: +43-1-4277-9618  
E: info@sysbio2014.org  
W: www.sysbio2014.org

### **SysBio2014 Course Office Zurich**

**Heide Marie Hess**  
SystemsX.ch  
Clausiusstr. 45, CLP D 7  
CH-8092 Zurich, Switzerland  
T: +41 44 632 02 50  
E: heide.hess@systemsx.ch

### **At the Venue**

**Regina Klaus & Heide Marie Hess**  
Hotel Grauer Bär\*\*\*\* Innsbruck  
Universitätsstrasse 5-7; A-6020 Innsbruck, Austria  
T: +43-512-5924-0 F: +43-512-574535  
e-mail: info@sysbio2014.org

Mobile: +43 676 455 3688

### **Registration & Web**

**Walter Glaser**  
Technical Management, Vienna, Austria

**SysBio2014 Financial Support & Aid**

**Organizing Institutions**



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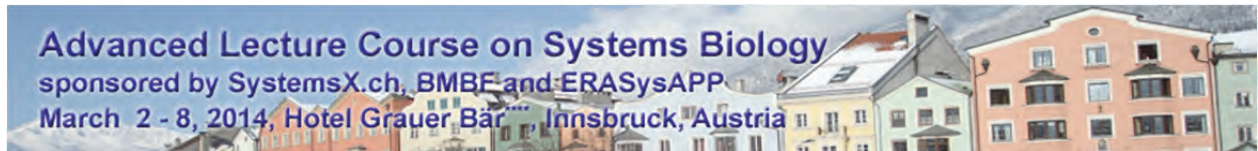


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## Welcome to SysBio2014 in Innsbruck!

The Organizers of SysBio2014 warmly welcome you to the 5<sup>th</sup> edition of the Advanced Lecture Course on Systems Biology.

10 years back, when Hans Westerhoff and Karl Kuchler initiated the first course, systems biology was the new kid on the block. It was suspiciously viewed by many as either just another buzz-word of little substance or as a bunch of old ideas recast into a new frame. Advanced by visionary colleagues, systems biology has now firmly established itself as a natural complement to the successful reductionism in molecular biology.

Initially, the educational landscape of systems biology was barren. Courses such as this offered one of the few opportunities to retrain biologists and theoreticians in each others' fields. Despite a growing number of systems biology curricula and local graduate schools, there is still a huge lack of computationally-inclined biologists and biologically-inclined computer scientists and physicists. This is mainly due to the nature of today's undergraduate curricula in biology, mathematics, engineering, and informatics. Both industry and academia suffer (not only in systems biology areas) from a lack of life scientists with quantitative training who can deal with larger, dynamic, heterogeneous or multi-scale data sets, yet maintain a deeper understanding of the biology. Hence, the Advanced Lecture Course on Systems Biology is as relevant today as it was 10 years ago.

Beyond saving the world, participants and teachers of past courses have formed a network of scientific and personal connections, with several former participants becoming teachers on the present course. We welcome the new batch of participants to the family!

Uwe Sauer

Edda Klipp

Ursula Kummer

Wolfgang Müller

Hans Westerhoff

Karl Kuchler

**The SysBio2014 Organizers**

## ***Principles behind the Scientific Program***

The course has been organized around the 5 symposia of **Cellular Decision Making**, **Network Biology**, **Medical Systems Biology**, **From Molecules to Functional Phenotypes** and **Systems Biology in Practice**. Delivered by world experts in each area, the dedicated morning sessions of the first 4 symposia consist of 3 plenary educational lectures on key methodologies, 3 parallel interactive tutorials, and again plenary lectures on exciting scientific results obtained by these methods. In the **Systems Biology in Practice Symposium**, industry experts will start with plenary lectures followed by parallel interactive tutorials and smaller group question sessions.

Intense interactions between participants and teachers have always been a hallmark of the course. In addition to many interactive lecture formats, teachers will be seated at individual dinner tables to be joined by students (likewise students from the same lab are kindly requested not to sit together). There are ample social interaction opportunities and intense poster sessions. Please use these unique opportunities intensively!

## ***Poster Sessions***

All posters should be on display during the entire SysBio2014 course to provide ample time for informal discussions among participants and lecturers. Posters corresponding to each symposium have been grouped together. During the first hour of each poster session on Monday, Tuesday and Thursday, 8-10 posters of each symposium (as indicated in the program) will be visited by a group of mentors that include teachers of that particular symposium. Feedback sessions for each of these poster groups will take place at 22:30 in the indicated rooms to discuss both science and presentation in a small group.

### **Mentoring teams for feedback sessions at 22:30**

#### **Cellular Decision Making:**

**Frank Bruggemann (Chair)**, Steven Altschuler, David Fell, Jacky Snoep, Olaf Wolkenhauer

#### **Network Biology:**

**Matthias Heinemann (Chair)**, Dana Pe'er, Nathan Price, Markus Covert, Hans Westerhoff

#### **Medical Systems Biology:**

**Ursula Klingmüller (Chair)**, Eytan Ruppin, Nadja Rosenthal, Wolfgang Müller, Edda Klipp

#### **From Molecules to Functional Phenotypes:**

**Ursula Kummer (Chair)**, Andrew Millar, Thomas Höfer, Terry Hwa, Mike Savageau

#### **Systems Biology in Practice:**

**Bas Teusink (Chair)**, Ed Drigger, Roel Bovenberg, Brett Olivier, Julio Saez Rodriguez, Maria Polychronidou

Chairs, please ensure that at least 3 mentors are available for each poster session!

## **Social Activities**

Afternoons are free for individual activities that include alpine skiing, hiking in the mountains, wellness and exploring Innsbruck. Lunch packages will be provided to the skiers to ensure sufficient time on the slopes, all others will enjoy a seated lunch (if you decide for a lunch package you need to pick up a lunch voucher in the lobby area the *day before*). Wednesday late afternoon we will have “**Gaudi Olympics**” that require appropriate winter outfit and solid, warm shoes.

**Lift tickets** can be purchased on a daily basis in the SysBio2014 Course Office during regular office hours at a **discounted price of € 18** (includes € 2 refundable deposit). On Saturday and Sunday, March 1 & 2, there is a free shuttle service to the **ski rental shop (10% discount on rentals upon showing your SysBio2014 badge)**.

A daily ski shuttle takes you from the front of the hotel to the “**Axamer Lizum**”: departure hotel at 12:50 from Monday-Friday (**attention Wednesday March 5 social event at 16:30!**)

The return shuttle leaves at 16:00 from the ski places. Moreover, you can sign up for **skiing lessons**, which usually last for three to five days.

### **Other activities:**

**Daily - Crystal World Wattens** - bus shuttle from Innsbruck “Museumstraße” at 13:04. The cost is **€UR 19,50** (including bus and entrance). Tickets can be purchased at the hotel front desk.

**Daily - Guided Tours Innsbruck** - Guided walking tours take place daily at 14:00 (€ 10). You may get further information at the hotel front desk.

## **Emergencies & Medicare**

Please call the **24-hour SysBio2012 Hotline +43 676 455 3688** or the front desk for assistance in case of an emergency. Physicians on duty are Dr. Stephan Cziep, Wilhelm Greil Strasse 21, A-6020 Innsbruck, Tel. +43 512 57 23 24 or the University Hospital Innsbruck, Anichstrasse 35, A-6020 Innsbruck, Tel. +43 505 04 0.

**IMPORTANT – The SysBio2014 Organizers cannot accept responsibility or liability for personal accidents, injuries, loss or damage to private property of SysBio2014 participants. Skiing and any leisure activities will be entirely at your own risk. Participants are thus strongly advised to make their own arrangements concerning personal insurance and health coverage if necessary or applicable.**

## **SysBio2014 Young Investigator Award**

All abstracts with graduate students or postdoctoral fellows as **first authors** are subject to scientific evaluation by a selected committee. The best abstract in each topic shall receive the “**SysBio Young Investigator Award**”.

## ***Scientific Program of SysBio2014***

Please note that all **posters as well as oral presentations** must be considered “***privileged personal communications***”. No data may be cited or used in any kind of verbal or written scientific correspondence with third parties without explicit permission of the presenting author.

## ***Invited Speakers / Chairs / Teachers***

<b>Aebersold</b>	Ruedi	<b>Klipp</b>	Edda	<b>Rosenthal</b>	Nadja
<b>Altschuler</b>	Steven	<b>Kuchler</b>	Karl	<b>Ruppin</b>	Eytan
<b>Bovenberg</b>	Roel	<b>Kummer</b>	Ursula	<b>Saez Rodriguez</b>	Julio
<b>Bruggeman</b>	Frank	<b>Küpfer</b>	Lars	<b>Sahle</b>	Sven
<b>Covert</b>	Markus	<b>Lemberger</b>	Thomas	<b>Sauer</b>	Uwe
<b>Driggers</b>	Edward	<b>Lichter</b>	Peter	<b>Savageau</b>	Mike
<b>Fell</b>	David	<b>Mendes</b>	Pedro	<b>Schilling</b>	Marcel
<b>Funahashi</b>	Akira	<b>Millar</b>	Andrew	<b>Serrano</b>	Luis
<b>Heinemann</b>	Matthias	<b>Müller</b>	Wolfgang	<b>Snoep</b>	Jacky
<b>Höfer</b>	Thomas	<b>Olivier</b>	Brett	<b>Teusink</b>	Bas
<b>Hwa</b>	Terry	<b>Pe'er</b>	Dana	<b>Westerhoff</b>	Hans
<b>Kirouac</b>	Daniel	<b>Pelkmans</b>	Lucas	<b>Wolkenhauer</b>	Olaf
<b>Klingmüller</b>	Ursula	<b>Price</b>	Nathan		

## ***Pre - Course Teaching***

### **Pre - Course Teaching (optional, March 2, 2014 all day)**

<b>Ursula Klingmüller</b>	Cell biology in a nutshell
<b>Marcel Schilling</b>	Computing in a nutshell
<b>David Fell</b>	Mathematical biochemistry in a nutshell
<b>Karl Kuchler</b>	Molecular genetics in a nutshell

## ***Keynote Plenary Lectures***

The following keynote lectures shall enrich SysBio2014:

Opening Keynote Lecture: **Nadja Rosenthal (AU)**

Closing Keynote Lecture: **Hans Westerhoff (NL, UK)**

## ***Blackboard Teaching***

Blackboard lectures and computer practicals will be held in parallel, each consisting of a set of 3 consecutive sessions. Please pick one each for the 16:30-17:30 and 17:45-18:45 slots and follow it through the course. Switching between lectures is possible, but consider that the 3 sessions build on each other.

In blackboard teaching sessions teachers carefully selected for this mode will explain in the simplest possible terms and in highly interactive mode, principles and methodologies.

### **Blackboard Teaching (Monday, Tuesday, Thursday afternoon)**

<b>Frank Bruggeman</b>	Origins of stochasticity in single cells: theory
<b>Edda Klipp</b>	Modeling signaling networks
<b>Bas Teusink</b>	Genome-scale metabolic models, their construction and analysis
<b>Olaf Wolkenhauer</b>	Efficient Communication of Interdisciplinary Research
<b>Julio Saez Rodriguez</b>	Logic models of signaling networks and training to phosphoproteomic data
<b>Matthias Heinemann</b>	Experimental tools for single cell analyses
<b>Mike Savageau</b>	Genotype to phenotype: Phenotypic deconstruction of complex biological systems

## ***Computer Practicals***

Computer practicals will demonstrate modern modeling and data analysis tools hand on. Students are advised to bring their **own laptops** to the practicals as the number of laptops provided by the organizers will be very limited. The software used for the practicals will be made available at the course site.

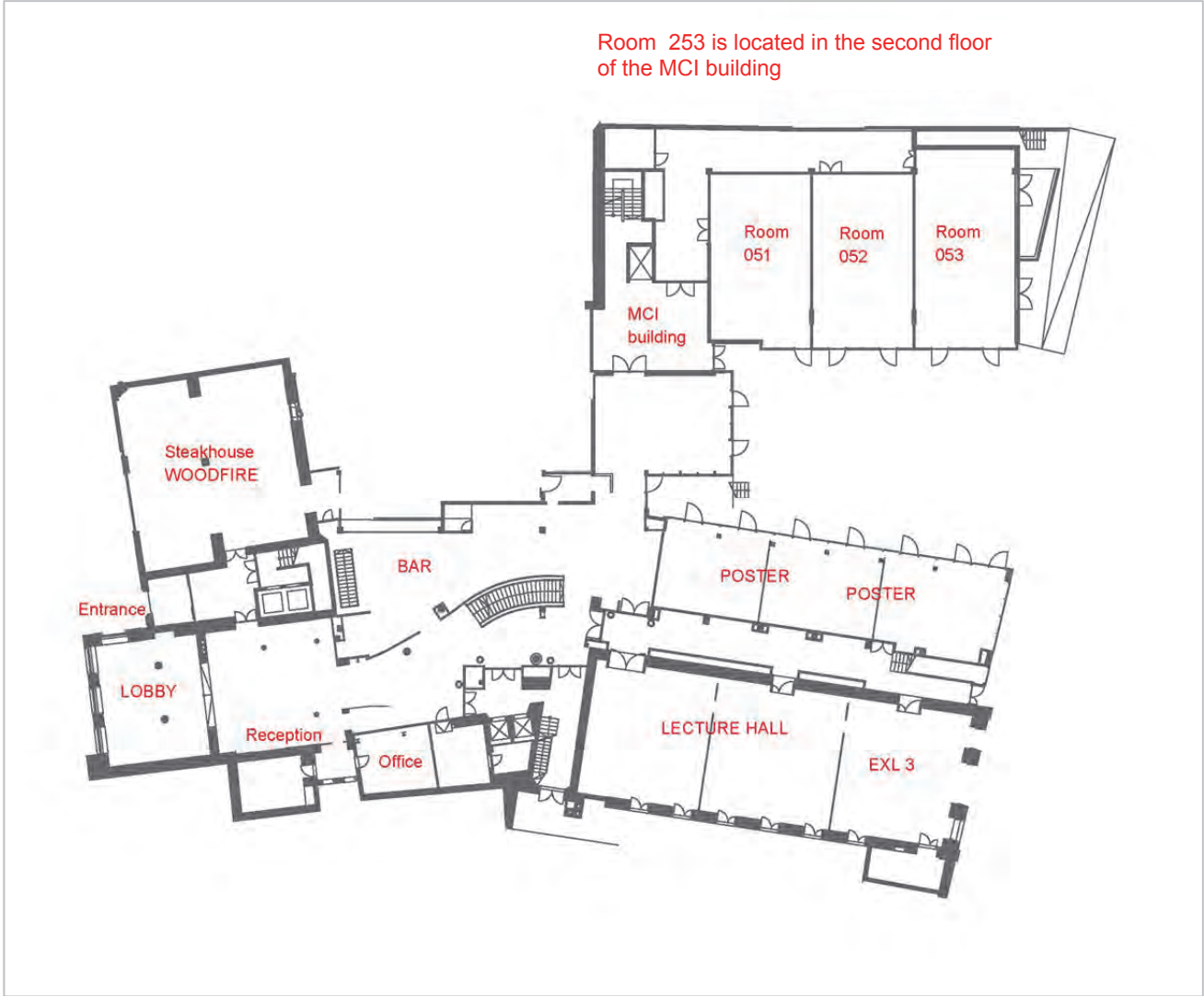
### **Computer Practicals (Monday, Tuesday, Thursday afternoon)**

<b>Brett Olivier</b>	Constraint Based Modelling with FAME
<b>Jacky Snoep</b>	Creating a transparent model workflow in JWS Online: model construction/validation/annotation and publication
<b>Wolfgang Müller</b>	Data mangement in practice
<b>Akira Funahashi</b>	CellDesigner: A process diagram editor for gene-regulatory and biochemical networks
<b>P. Mendes/S. Sahle/U. Kummer</b>	Introduction to modeling (using COPASI)



# Floor Plan

## Ground floor of the course hotel in Innsbruck





# SYSBIO2014 AT A GLANCE

	March 1 Saturday	March 2 Sunday	March 3 Monday	March 4 Tuesday	March 5 Wednesday	March 6 Thursday	March 7 Friday	March 8 Saturday
<b>Breakfast</b>		07:00-08:30 <b>PRE-COURSE</b> 08:30 - 09:00 registration <b>4 parallel courses</b> 09:00-10:30 part I break 11:00-12:30 part II	07:00-08:30 Symposium 1 <b>Cellular Decision Making</b> Chair: <i>F. Bruggeman</i>  Steven Altschuler Ruedi Aebersold Luis Serrano	07:00-08:30 Symposium 2 <b>Network Biology</b> Chair: <i>M. Heinemann</i>  Dana Pe'er Nathan Price Terry Hwa	07:00-08:30 Symposium 3 <b>Medical Systems Biology</b> Chair: <i>Edda Klipp</i>  Lucas Peikmans Eytan Ruppin Karl Kuchler	07:00-08:30 Symposium 4 <b>From Molecules to Functional Phenotypes</b> Chair: <i>U. Kummer</i>  Andrew Millar Thomas Höfer Markus Covert	07:00-08:30 Symposium 5 <b>Systems Biology in Practice</b> Chair: <i>B. Teusink</i>  Roel Bovenberg Daniel Kirouac Ed Driggers Lars Küpfer	07:00-08:30 <b>End of SysBio2014 Check-Out</b>  <b>Shuttles Airport &amp; Train Station</b>
<b>Lunch &amp; Break</b>		12:30 - 13:30 <b>4 parallel courses</b>	12:30 - 16:30 <b>Blackboard Teaching and Computer Practicals</b>  16:30-17:30 <b>Session A – part 1</b>  17:45-18:45 <b>Session B – part 1</b>	12:30 - 16:30 <b>Blackboard Teaching and Computer Practicals</b>  16:30- 7:30 <b>Session A – part 2</b>  17:45-18:45 <b>Session B – part 2</b>	12:30 - 16:30  16:30 departure  <b>GAUDI OLYMPIADE</b> in Seefelds	12:30 - 16:30 <b>Blackboard Teaching and Computer Practicals</b>  16:30-17:30 <b>Session A – part 3</b>  17:45-18:45 <b>Session B – part 3</b>	12:30 - 16:30 16:30-18:15 <b>Systems Biology and Society</b> Chair: <i>Uwe Sauer</i> Thomas Lemberger Peter Lichter  18:15-18:45 <b>Sysbio2014 Award</b>  18:45-19:45 <b>CLOSING SESSION</b> Chair: <i>U. Sauer,</i> <i>K. Kuchler</i> <b>Closing Lecture</b> H. Westerhoff	
<b>Dinner</b>	18:30 - 20:00  Poster Mounting	19:00 - 20:25 <b>Welcome Dinner</b>  20:30-21:30 <b>OPENING CEREMONY</b>  <b>Welcome Note</b> U. Sauer, K. Kuchler <b>Opening Lecture</b> N. Rosenthal	18:50 - 19:50  20:00-20:45 <b>Short Talks</b> A. Lapytsko M. Schelker C. Tönsing  21:00-22:30 <b>Poster Session 1</b> PS1-01 – PS1-39	18:50 - 19:50  20:00-20:45 <b>Short Talks</b> P. Barah A. Bensimon E. Noor  21:00-22:30 <b>Poster Session 2</b> PS2-01 – PS2-38	20:00 - 21:00  20:00 - 21:00	18:50 - 19:50  20:00-20:45 <b>Short Talks</b> N.J. Stanford K. Tummler J. Hausser  21:00-22:30 <b>Poster Session 3</b> PS3-01 – PS3-41	20:00 - 21:00  21:00 - open end  <b>FAREWELL PARTY</b>	

# POSTER SESSIONS

Monday, Tuesday, Thursday from 21:00-22:30

	poster #	Cellular decision making	poster #	Network biology	poster #	Medical systems biology	poster #	From molecules to functional phenotypes	poster #	Systems biology in practice				
<b>M O N D A Y</b>	1	PS1-01 Nordholt	<b>Monday</b>	<b>Monday</b>	PS1-09 Lindhorst	<b>Monday</b>	<b>Monday</b>	<b>Monday</b>	<b>Monday</b>	<b>Monday</b>				
	2	PS1-02 Wagner			PS1-10 Kühne						PS1-17 Wegryzn	PS1-24 Theodosiou	PS1-32 Christodoulou	
	3	PS1-03 Benzinger			PS1-11 Thobe						PS1-18 Hass	PS1-25 Dvornikov	PS1-33 von Wulffen	
	4	PS1-04 Davidi			PS1-12 Serrano-Solano						PS1-19 Kok	PS1-26 Noor	PS1-34 Anlink	
	5	PS1-05 Rastgoutalemi			PS1-13 Pal						PS1-20 Kozakiewicz	PS1-27 Chia	PS1-35 Merzouki	
	6	PS1-06 Gunther			PS1-14 Bosque Chacón						PS1-21 Flossdorf	PS1-28 Linke	PS1-36 Urquiza García	
	7	PS1-07 Konrath			PS1-15 Kogadeeva						PS1-22 Kalra	PS1-29 Lukacisin	PS1-37 Hepp	
	8	PS1-08 Beuke			PS1-16 Maarleveld						PS1-23 Geiger	PS1-30 Goldenbogen	PS1-38 Salopiata	
<b>T U E S D A Y</b>	1	PS2-01 Papagiannakis	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>	<b>Tuesday</b>				
	2	PS2-02 Barile									PS2-09 Marín de Mas	PS2-17 Oppelt	PS2-24 Dravecká	PS2-32 Groeneveld
	3	PS2-03 Roth									PS2-10 Herrera Dominguez	PS2-18 Martines	PS2-25 Maser	PS2-33 Gábor
	4	PS2-04 Saque Henriques									PS2-11 Megchelebrink	PS2-19 Legewie	PS2-26 Rabbers	PS2-34 Fuhrer
	5	PS2-05 Buffing									PS2-12 Veith	PS2-20 Blattmann	PS2-27 Dusny	PS2-35 Singh
	6	PS2-06 Yasar Yildiz									PS2-13 Bereketoglu	PS2-21 Dimitrov	PS2-28 Goh	PS2-36 Keller
	7	PS2-07 Uschner									PS2-14 Matos	PS2-22 Módos	PS2-29 Lomnitz	PS2-37 Kuzmanovska
	8	PS2-08 Gunaratne									PS2-15 Kuiper	PS2-23 Scheiker	PS2-30 Barberis	PS2-38 Peebo
<b>T H U R S D A Y</b>	1	PS3-01 Rosenblatt	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>	<b>Thursday</b>				
	2	PS3-02 Bensimon									PS3-10 Leupold	PS3-19 Maiwald	PS3-26 Sévin	PS3-35 Stavrum
	3	PS3-03 Hauser									PS3-11 Adhikari	PS3-20 Flötzmann	PS3-27 Cappelletti	PS3-36 Stanford
	4	PS3-04 Behrends									PS3-12 Silverbush	PS3-21 Schulte	PS3-28 Krebs	PS3-37 Tummler
	5	PS3-05 Yugi									PS3-13 Zhukova	PS3-22 Stolle	PS3-29 Kewai	PS3-38 Yilmaz
	6	PS3-06 Lapytsko									PS3-14 Schumacher	PS3-23 Heil	PS3-30 Barah	PS3-39 Mikelson
	7	PS3-07 Payne									PS3-15 Hanemaaijer	PS3-24 Kochanowski	PS3-31 Heiland	PS3-40 Dias Fernandes
	8	PS3-08 Krantz									PS3-16 Wang	PS3-25 Sanwald	PS3-32 Bueno Amorós	PS3-41 Gonzalez Vaigas
	9	PS3-09 Barenholz									PS3-17 Tönsing	PS3-26 Pino	PS3-33 Yssel	PS3-42 Gregersen
<b>Feedback Session</b> (presenters and mentors) 22:30-23:00		Lecture Hall	Room EXL 3	Room 051	Room 052	Room 053								

## SCIENTIFIC PROGRAM – Pre-Courses

### Saturday, March 1, 2014 – Pre-course Registration

17:00 – 18:30 20:00 – 22:00	<i>Pre-course pick up of badge &amp; course material</i>	<i>Lobby</i>
18:30 – 20:00	<i>Dinner</i>	<i>Restaurant</i>

### Sunday, March 2, 2014 – Pre-courses

08:30 – 09:00	<i>Pre-course pick up of badge &amp; course material</i>		<i>Lobby</i>
<b>09:00 – 10:30</b>	<b>4 parallel pre-courses - part I</b>		<b>In groups</b>
	PC-01	<b>David Fell</b> Mathematical Biochemistry in a nutshell	Room 051
	PC-02	<b>Marcel Schilling</b> Computing in a nutshell	Room 052
	PC-03	<b>Ursula Klingmüller</b> Cell Biology in a nutshell	Room 053
	PC-04	<b>Karl Kuchler</b> Molecular Genetics in a nutshell	Room EXL 3
10:30 – 11:00	<i>Coffee break</i>		
<b>11:00 – 12:30</b>	<b>4 parallel pre-courses - part II</b>		Rooms EXL 3, 051, 052, 053
12:30 – 13:30	<i>Lunch</i>		<i>Restaurant</i>
<b>13:30 – 15:00</b>	<b>4 parallel pre-courses - part III</b>		Rooms EXL 3, 051, 052, 053
15:00 – 15:30	<i>Coffee break</i>		
<b>15:30 – 17:00</b>	<b>4 parallel pre-courses - part IV</b>		Rooms EXL 3, 051, 052, 053

## **ABSTRACTS Pre-Courses**

### ***PC-01 Mathematical biochemistry in a nutshell***

#### **David Fell**

Biological & Medical Sciences, Oxford Brookes University, Gipsy Lane, Oxford OX3 0BP, UK

This precourse is designed for those less familiar with the mathematical aspects of modelling and systems biology. The aim is not to improve anyone's competence in mathematics, but to provide a basic introduction to some of the main mathematical concepts and computational techniques used to represent and model biological systems. The selection of topics is designed to underpin the main course and consists of:

- Functions, parameters and variables
- Calculating time courses from ordinary differential equations
- Matrices and vectors
- Mathematical representation of cellular systems
- Sensitivity analysis - illustrated with metabolic control analysis

### ***PC-02 Computation in a Nutshell***

#### **Marcel Schilling, PhD**

Systems Biology of Signal Transduction, German Cancer Research Center (DKFZ), Im Neuenheimer Feld 280, 69120 Heidelberg, Germany, +49 6221 42 4485, m.schilling@dkfz.de

Biological processes such as signal transduction and subsequent target gene expression are governed by highly complex molecular mechanisms. Mathematical models consisting of ordinary differential equations (ODEs) are a frequently used approach that facilitates systematic network analyses. These models allow to test hypothesis about the biological processes and to predict cellular properties that are not accessible by experiments.

In this precourse, students and researchers with a biological background will be introduced to quantitative dynamic modeling of biological systems. We will start with describing simple examples of molecular interactions based on mass action kinetics. Then, more complex enzyme kinetics will be explained and we will introduce the establishment of ODEs. Finally, the basics of numerical integration and deterministic and stochastic simulations will be discussed. The introduced concepts will allow the participants to formulate the ODEs and describe the dynamics of exemplary signaling pathways.

The examples will be established and simulated interactively using the freely available software Copasi ([www.copasi.org](http://www.copasi.org)). Participants are encouraged to bring their own laptops and to pre-install the software. A background in mathematics or computational biology is not required for this precourse. Basic knowledge in biochemistry and signal transduction is of advantage.

### ***PC-03 Cell Biology in a Nutshell***

**Ursula Klingmüller**

DKFZ, Im Neuenheimer Feld 280, Heidelberg 69120, Germany

The lecture will cover principle concepts in cell biology and will introduce relevant techniques used for experimental data generation for modeling purposes. Specifically, structural differences of cells and the function of organelles will be introduced. An overview of extracellular signals such as growth factors and hormones will be given and principal mechanisms facilitating signal transduction from the cell surface to the cell nucleus will be summarized. Key cellular responses and the underlying mechanisms will be illustrated.

To explain differences in time and spatial scales the impact of cellular decisions on reactions at the tissue up to organ level will be described. Furthermore, an overview of specific techniques for data generation and strategies for data processing as well as suitability of experimental data for different modeling approaches will be provided.

### ***PC-04 Molecular genetics in a nutshell***

**Karl Kuchler**

Medical University Vienna, Department of Medical Biochemistry, Dr. Bohr-Gasse 9/2, 1030 Vienna, Austria

Systems biology (SysBio) aims to gain a systems-level understanding of organismic, cellular or even subcellular pathway behaviour to identify novel as well as emerging principles of a living system. The long-term hope is to be able to better predict and cure diseases of complex genetic origin. One of the key features of SysBio is the integration of a multitude of quantitative biological data (deep-sequencing, SNP and mutations, genetic interactions, microarrays, proteomics, metabolomics, etc.) with various applicable mathematical modelling approaches. While modelling and the use of proper algorithms depends on the question and hypothesis to be addressed, the generation of quantitative biological data often poses unsurmountable technical problems or are even impossible with the current methodologies. This is especially true for measuring the dynamics and time-scale of biological processes from transcription, translation to post-translational modification as well as the kinetics of intracellular biomolecule trafficking. Likewise, pathway architectures and features often result from complex genetic interactions, which respond to various types of input, making parameter estimation for modeling a difficult task. In this pre-course teaching on molecular genetics for theoreticians and modellers, I will try to use simple model systems such as yeast as an example to explain how and which kind of experimental (genetic) data can be obtained from eukaryotic cells in a (near)-quantitative manner and which technical issues and pitfalls apply to some of the current state-of-the-art technologies to study the dynamics of biological processes related to signal transduction.

**SCIENTIFIC PROGRAM – Advanced Lecture Course**

**Sunday, March 2, 2014 - Opening Session**

16:30 – 18:30	Course registration	Lobby
17:30 – 18:30	Informal get-together	Bar
17:30 – 19:00	Poster mounting	Poster Gallery
19:00 – 20:25	Welcome dinner	Restaurant
<b>20:30 – 21:30</b>	<b>Opening Session</b> <i>Chair: Uwe Sauer</i>	Lecture Hall
20:30 – 20:40	<b>Welcome Note</b> Uwe Sauer, Karl Kuchler	Lecture Hall
20:40 – 21:20	OL-01: <b>Opening Lecture - Nadja Rosenthal (AUS)</b> Systems approaches to regenerative medicine	Lecture Hall
21:20 – 21:30	<b>Discussion</b>	Lecture Hall
20:30 – 22:00	Late course registration	Lobby



## Monday, March 3, 2014

07:00 – 08:30	<i>Breakfast</i>	<i>Restaurant</i>
<b>08:30 – 12:30</b>	<b>Cellular Decision Making</b> <i>Chair: Frank Bruggemann</i>	
<b>08:30 – 09:45</b>	<b>Methodology Lectures</b>	<b>Plenary</b>
08:30 – 08:35	Chair's introduction	Lecture hall
08:35 – 08:55	S1-L01: <b>Steven Altschuler</b> (US) Using computer vision to identify functional heterogeneity in cellular populations	Lecture hall
08:55 – 09:15	S1-L02: <b>Ruedi Aebersold</b> (CH) Proteomic data for systems biology	Lecture hall
09:15 – 09:35	S1-L03: <b>Luis Serrano</b> (ES) Full quantitative understanding of a living system, is this possible?	Lecture hall
<b>09:45 – 10:30</b>	<b>Parallel tutorials corresponding to lectures</b>	<b>Parallel</b>
	<b>Steven Altschuler</b>	Room 051
	<b>Ruedi Aebersold</b>	Room 052
	<b>Luis Serrano</b>	Room 053
10:30 – 11:00	<i>Coffee break</i>	
<b>11:00 – 12:30</b>	<b>Lectures on results</b>	<b>Plenary</b>
11:00 – 11:25	<b>Steven Altschuler</b>	Lecture hall
11:25 – 11:50	<b>Ruedi Aebersold</b>	Lecture hall
11:50 – 12:15	<b>Luis Serrano</b>	Lecture hall
12:15 – 12:30	<b>General questions, chair's summary and awarding of best student question prize</b>	Lecture hall
12:30 – 16:00	<i>Lunch (package) and ski break</i>	
16:00 – 16:30	<i>Tea &amp; coffee</i>	
16:30 – 18:45	<b>Blackboard teaching (BB) and Computer Practicals (CP)</b>	
16:30 – 17:30	<b>Session A – part 1</b>	<b>Parallel</b>
	BB-01: <b>Frank Bruggeman</b> Origins of stochasticity in single cells: theory	Lecture Hall
	BB-02: <b>Julio Saez Rodriguez</b> Logic models of signalling networks and training to phosphoproteomic data	Room EXL 3
	BB-03: <b>Matthias Heinemann</b> Experimental tools for single cell analyses	Room 051
	CP-01: <b>Akira Funahashi</b> CellDesigner: A process diagram editor for gene-regulatory and biochemical networks	Room 052
	CP-02: <b>Ursula Kummer, Sven Sahle, Pedro Mendes</b> Introduction to modeling (using COPASI)	Room 053

	CP-03: <b>Jacky Snoep</b> Creating a transparent model workflow in JWS Online: model construction/validation/annotation and publication	Room 253
17:45 – 18:45	<b>Session B – part 1</b>	<b>Parallel</b>
	BB-04: <b>Mike Savageau</b> Genotype to phenotype: Phenotypic deconstruction of complex biological systems	Lecture Hall
	BB-05: <b>Olaf Wolkenhauer</b> Efficient Communication of Interdisciplinary Research	Room EXL 3
	BB-06: <b>Edda Klipp</b> Modeling signaling networks	Room 051
	BB-07: <b>Bas Teusink</b> Genome-scale metabolic models, their construction and analysis	Room 052
	CP-04: <b>Wolfgang Müller</b> Data mangement in practice	Room 053
	CP-05: <b>Brett Olivier</b> Constraint based modelling with FAME	Room 253
18:50 – 19:50	<i>Dinner</i>	<i>Restaurant</i>
20:00 – 20:45	<b>Short Talks</b>	<b>Plenary</b>
20:00 – 20:15	ST-01: <b>Anastasiya Lapytsko</b> Auto-inhibition suppresses oscillations in biochemical delayed negative feedback systems	Lecture hall
20:15 – 20:30	ST-02: <b>Max Schelker</b> A spatial model to unravel the transport strategy of the influenza A genome in the host cell	Lecture hall
20:30 – 20:45	ST-03: <b>Christian Tönsing</b> Cause and cure of sloppiness in ordinary differential equation models	Lecture hall
21:00 – 22:30	<b>Poster Session 1</b>	<b>In groups</b>
21:00 – 21:45	Presentation of posters <b>PS1-01 to PS1-39</b>	Poster Gallery
21:45 – 22:30	Free poster viewing	Poster Gallery
22:30 – 23:00	<b>Feedback session for poster presenters</b> (presenters and mentoring teams only)	Lecture Hall, Rooms EXL3, 051, 052, 053

## Tuesday, March 4, 2014

07:00 – 08:30	<i>Breakfast</i>	<i>Restaurant</i>
<b>08:30 – 12:30</b>	<b>Network Biology</b> <i>Chair: Matthias Heinemann</i>	
<b>08:30 – 09:45</b>	<b>Methodology Lectures</b>	<b>Plenary</b>
08:30 – 08:35	Chair's introduction	
08:35 – 08:55	S2-L01: <b>Dana Pe'er</b> (US) Inferring Networks from multidimensional single cell data	Lecture hall
08:55 – 09:15	S2-L02: <b>Nathan Price</b> (US) Integrative modeling of metabolic and regulatory networks	Lecture hall
09:15 – 09:35	S2-L03: <b>Terry Hwa</b> (US) On growth laws, catabolite repression, and metabolic coordination	Lecture hall
<b>09:45 – 10:30</b>	<b>Parallel tutorials corresponding to lectures</b>	<b>In groups</b>
	<b>Dana Pe'er</b>	Room 051
	<b>Nathan Price</b>	Room 052
	<b>Terry Hwa</b>	Room 053
10:30 – 11:00	<i>Coffee break</i>	
<b>11:00 – 12:30</b>	<b>Lectures on results</b>	<b>Plenary</b>
11:00 – 11:25	<b>Dana Pe'er</b>	Lecture hall
11:25 – 11:50	<b>Nathan Price</b>	Lecture hall
11:50 – 12:15	<b>Terry Hwa</b>	Lecture hall
12:15 – 12:30	<b>General questions, chair's summary and awarding of best student question prize</b>	Lecture hall
12:30 – 16:00	<i>Lunch (package) and ski break</i>	
16:00 – 16:30	<i>Tea &amp; coffee</i>	
16:30 – 18:45	<b>Blackboard teaching (BB) and Computer Practicals (CP)</b>	
16:30 – 17:30	<b>Session A – part 2</b>	<b>Parallel</b>
	BB-01: <b>Frank Bruggeman</b> Origins of stochasticity in single cells: theory	Lecture Hall
	BB-02: <b>Julio Saez Rodriguez</b> Logic models of signalling networks and training to phosphoproteomic data	Room EXL 3
	BB-03: <b>Matthias Heinemann</b> Experimental tools for single cell analyses	Room 051
	CP-01: <b>Akira Funahashi</b> CellDesigner: A process diagram editor for gene-regulatory and biochemical networks	Room 052
	CP-02: <b>Ursula Kummer, Sven Sahle, Pedro Mendes</b> Introduction to modeling (using COPASI)	Room 053

	CP-03: <b>Jacky Snoep</b> Creating a transparent model workflow in JWS Online: model construction/validation/annotation and publication	Room 253
17:45 – 18:45	<b>Session B – part 2</b>	<b>Parallel</b>
	BB-04: <b>Mike Savageau</b> Genotype to phenotype: Phenotypic deconstruction of complex biological systems	Lecture Hall
	BB-05: <b>Olaf Wolkenhauer</b> Efficient Communication of Interdisciplinary Research	Room EXL 3
	BB-06: <b>Edda Klipp</b> Modeling signaling networks	Room 051
	BB-07: <b>Bas Teusink</b> Genome-scale metabolic models, their construction and analysis	Room 052
	CP-04: <b>Wolfgang Müller</b> Data mangement in practice	Room 053
	CP-05: <b>Brett Olivier</b> Constraint based modelling with FAME	Room 253
18:50-19:50	<i>Dinner</i>	<i>Restaurant</i>
20:00 – 20:45	<b>Short Talks</b>	<b>Plenary</b>
20:00 – 20:15	ST-04: <b>Pankaj Barah</b> Transcriptional regulatory networks in Arabidopsis thaliana ecotypes during response to five single and six combined stresses	Lecture hall
20:15 – 20:30	ST-05: <b>Ariel Bensimon</b> Modeling the Cellular Phosphorylation Response to Double Strand Breaks Using Quantitative Mass Spectrometry	Lecture hall
20:30 – 20:45	ST-06: <b>Elad Noor</b> Connecting Pathway Thermodynamics to Enzyme Investment	Lecture hall
21:00 – 22:30	<b>Poster Session 2</b>	<b>In groups</b>
21:00 – 21:45	Presentation of posters <b>PS2-01 – PS2-38</b>	Poster Gallery
21:45 – 22:30	Free poster viewing	Poster Gallery
22:30 – 23:00	<b>Feedback session for poster presenters</b> (presenters and mentoring teams only)	Lecture Hall, Rooms EXL3, 051, 052, 053

## Wednesday, March 5, 2014

07:00 – 08:30	<i>Breakfast</i>	<i>Restaurant</i>
<b>08:30 – 12:30</b>	<b>Medical Systems Biology</b> <i>Chair: Edda Klipp</i>	
<b>08:30 – 09:45</b>	<b>Methodology Lectures</b>	<b>Plenary</b>
08:30 – 08:35	Chair's introduction	
08:35 – 08:55	S3-L01: <b>Lucas Pelkmans</b> (CH) Systems biology of virus infection in mammalian cells	Lecture hall
08:55 – 09:15	S3-L02: <b>Eytan Ruppin</b> (IS) Predicting novel cancer drug targets	Lecture hall
09:15 – 09:35	S3-L03: <b>Karl Kuchler</b> (AT) Dual-systems biology and network inference to study microbial pathogenesis and host pathogen interplays	Lecture hall
<b>09:45 – 10:30</b>	<b>Parallel tutorials corresponding to lectures</b>	<b>In groups</b>
	<b>Lucas Pelkmans</b>	Room 051
	<b>Eytan Ruppin</b>	Room 052
	<b>Karl Kuchler</b>	Room 053
<b>10:30 – 11:00</b>	<i>Coffee break</i>	
<b>11:00 – 12:30</b>	<b>Lectures on results</b>	<b>Plenary</b>
11:00 – 11:25	<b>Lucas Pelkmans</b>	Lecture hall
11:25 – 11:50	<b>Eytan Ruppin</b>	Lecture hall
11:50 – 12:15	<b>Karl Kuchler</b>	Lecture hall
12:15 – 12:30	<b>General questions, chair's summary and awarding of best student question prize</b>	Lecture hall
12:30 – 16:00	<i>Lunch (package) and ski break</i>	
<b>16:30</b>	<b>Departure 'Gaudi Olympics'</b>	<b>Lobby</b>
20:00- 21:00	<i>Dinner</i>	<i>Restaurant</i>

## Thursday, March 6, 2014

07:00 – 08:30	<i>Breakfast</i>	<i>Restaurant</i>
<b>08:30 – 12:30</b>	<b>From Molecules to Functional Phenotypes</b> <i>Chair: Ursula Kummer</i>	
<b>08:30 – 09:45</b>	<b>Methodology Lectures</b>	<b>Plenary</b>
08:30 – 08:35	Chair's introduction	
08:35 – 08:55	S4-L01: <b>Andrew Millar</b> (UK) Unwinding the circadian clock across multiple scales, from gene circuits to plant biomass	Lecture hall
08:55 – 09:15	S4-L02: <b>Thomas Höfer</b> (D) Stem cell fate by numbers: immunity and hematopoiesis	Lecture hall
09:15 – 09:35	S4-L03: <b>Markus Covert</b> (US) Accelerated discovery via a whole-cell mode	Lecture hall
<b>09:45 – 10:30</b>	<b>Parallel tutorials corresponding to lectures</b>	<b>In groups</b>
	<b>Andrew Millar</b>	Room 051
	<b>Thomas Höfer</b>	Room 052
	<b>Markus Covert</b>	Room 053
10:30 – 11:00	<i>Coffee break</i>	
<b>11:00 – 12:30</b>	<b>Lectures on results</b>	<b>Plenary</b>
11:00 – 11:25	<b>Andrew Millar</b>	Lecture hall
11:25 – 11:50	<b>Thomas Höfer</b>	Lecture hall
11:50 – 12:15	<b>Markus Covert</b>	Lecture hall
12:15 – 12:30	<b>General questions, chair's summary and awarding of best student question prize</b>	Lecture hall
12:30 – 16:00	<i>Lunch (package) and ski break</i>	
16:00 – 16:30	<i>Tea &amp; coffee</i>	
16:30 – 18:45	<b>Blackboard teaching (BB) and Computer Practicals (CP)</b>	
16:30 – 17:30	<b>Session A – part 3</b>	<b>Parallel</b>
	BB-01: <b>Frank Bruggeman</b> Origins of stochasticity in single cells: theory	Lecture Hall
	BB-02: <b>Julio Saez Rodriguez</b> Logic models of signalling networks and training to phosphoproteomic data	Room EXL 3
	BB-03: <b>Matthias Heinemann</b> Experimental tools for single cell analyses	Room 051
	CP-01: <b>Akira Funahashi</b> CellDesigner: A process diagram editor for gene-regulatory and biochemical networks	Room 052
	CP-02: <b>Ursula Kummer, Sven Sahle, Pedro Mendes</b> Introduction to modeling (using COPASI)	Room 053



	CP-03: <b>Jacky Snoep</b> Creating a transparent model workflow in JWS Online: model construction/validation/annotation and publication	Room 253
17:45 – 18:45	<b>Session B – part 3</b>	<b>Parallel</b>
	BB-04: <b>Mike Savageau</b> Genotype to phenotype: Phenotypic deconstruction of complex biological systems	Lecture Hall
	BB-05: <b>Olaf Wolkenhauer</b> Efficient Communication of Interdisciplinary Research	Room EXL 3
	BB-06: <b>Edda Klipp</b> Modeling signaling networks	Room 051
	BB-07: <b>Bas Teusink</b> Genome-scale metabolic models, their construction and analysis	Room 052
	CP-04: <b>Wolfgang Müller</b> Data mangement in practice	Room 053
	CP-05: <b>Brett Olivier</b> Constraint based modelling with FAME	Room 253
18:50 – 19:50	<i>Dinner</i>	<i>Restaurant</i>
20:00 – 20:45	<b>Short Talks</b>	<b>Plenary</b>
20:00 – 20:15	ST-07: <b>Natalie J. Stanford</b> Can stoichiometric modelling offer insights into optimal experimental design in biotechnology?	Lecture hall
20:15 – 20:30	ST-08: <b>Katja Tummler</b> Dynamic mathematical modeling explores the metabolic flexibility of mycobacteria	Lecture hall
20:30 – 20:45	ST-09: <b>Jean Hausser</b> Timescales and bottlenecks in microRNA-dependent gene regulation	Lecture hall
21:00 – 22:30	<b>Poster Session 3</b>	<b>In groups</b>
21:00 – 21:45	Presentation of posters <b>PS3-01 – PS3-42</b>	Poster Gallery
21:45 – 22:30	Free poster viewing	Poster Gallery
22:30 – 23:00	<b>Feedback session for poster presenters</b> (presenters and mentoring teams only)	Lecture Hall, Rooms EXL3, 051, 052, 053

## Friday, March 7, 2014

07:00 – 08:30	<i>Breakfast</i>	<i>Restaurant</i>
<b>08:30 – 12:30</b>	<b>Systems Biology in Practice (industry/medicine)</b> <i>Chair: Bas Teusink</i>	
<b>08:30 – 11:00</b>	<b>Industry insights</b>	<b>Plenary</b>
08:30 – 08:35	Chair's introduction	
08:35 – 9:10	S5-L01: <b>Daniel Kirouac</b> , Merrimack Pharmaceuticals (US) Using systems-modeling to advance oncology drug development	Lecture hall
9:10 – 9:45	S5-L02: <b>Roel Bovenberg</b> , DSM Food Specialities (NL) Metabolic Engineering from an industrial perspective	Lecture hall
9:45 – 10:20	S5-L03: <b>Ed Driggers</b> , Agios Pharmaceuticals (US) Integration of metabolomic and transcriptional profiles reveals metabolic pathways during macrophage polarization	Lecture hall
10:20 – 10:55	S5-L04: <b>Lars Küpfer</b> , Bayer AG (D) An introduction to physiology-based pharmacokinetic (PBPK) modeling	Lecture hall
10:55 – 11:10	<b>General questions, chair's summary and awarding of best student question prize</b>	Lecture hall
11:10 – 11:40	<i>Coffee break</i>	
<b>11:40 – 12:30</b>	<b>Parallel tutorials corresponding to lectures</b>	<b>In groups</b>
	<b>Roel Bovenberg</b>	Lecture hall
	<b>Daniel Kirouac</b>	Room 051
	<b>Ed Drigger</b>	Room 052
	<b>Lars Küpfer</b>	Room 053
12:30 – 16:00	<i>Lunch (package) and ski break</i>	
16:00 – 16:30	<i>Tea &amp; coffee</i>	
<b>16:30 – 18:45</b>	<b>Systems Biology and Society</b> <i>Chair: Uwe Sauer</i>	<b>Plenary</b>
16:30 – 16:35	Chair's introduction	Lecture hall
16:35 – 17:05	AS-01: <b>Thomas Lemberger</b> , Molecular Systems Biology (D) Scientific papers as open discovery tools	Lecture hall
17:05 – 17:45	AS-02: <b>Peter Lichter</b> , DKFZ (D) The EURAT project - ethical and legal aspects of whole genome sequencing	Lecture hall
17:45 – 18:15	Discussion	Lecture hall
18:15 – 18:45	<b>Wine break with presentation of Sysbio2014 Young Investigator Award</b>	

<b>18:45 – 19:45</b>	<b>Closing Session</b> <i>Chair: Uwe Sauer &amp; Karl Kuchler</i>	Lecture hall
18:45 – 19:30	CL-01: <b>Closing Lecture – Hans Westerhoff</b> Discovering (Systems) Biology	Lecture hall
19:30-19:45	<b>Course Closure</b> Uwe Sauer & Karl Kuchler	
20:00 – 21:00	<i>Banquet</i>	<i>Restaurant</i>
21:30	<i>Farewell party</i>	<i>Lecture hall</i>

**Saturday, March 8, 2014**

**Check out and transfers**

07:00 – 8:30	Breakfast
05:00 – 10:00	Check out at the hotel and departure
05:00 – 12:00	Shuttle to Innsbruck airport and train station