



THE HEBREW UNIVERSITY OF JERUSALEM
ISRAEL INSTITUTE FOR ADVANCED STUDIES

Stochastic Processes in the Cell Cycle

June 13-17, 2016

All lectures will take place at the Israel Institute for Advanced Studies, Lecture Hall 130
on the Edmond J. Safra, Givat Ram Campus

Organizers:

Ariel Amir (Harvard University)

Nathalie Q Balaban (The Hebrew University of Jerusalem)

Naama Barkai (Weizmann Institute of Science)

Program

Monday, 13 June

- 12:00 - 13:10 **Terence Hwa** (University of California, San Diego)
Pre-Workshop Lecture
Physics Colloquium - Levin Hall
Statistical Physics and Biology: a Stimulating Partnership
- 15:00 - 16:00 Registration
- 16:00 - 16:15 **Nathalie Q Balaban** (The Hebrew University of Jerusalem)
Welcome and Introductions
- 16:20 - 17:20 Opening Talks
Chair: **Ariel Amir** (Harvard University)
- Andrew Murray** (Harvard University)
How yeast fare in an uncertain world
- Johan Paulsson** (Harvard University)
Suppressing random fluctuations in cells
- 17:30 - 20:00 Reception and Poster Session

Tuesday, 14 June

- 09:00 - 10:00 Quantitative Analysis of Growth
Chair: **Johan Paulsson** (Harvard University)
- Terence Hwa** (University of California, San Diego)
On the maintenance of protein synthesis at slow growth
- Naama Brenner** (Technion, Israel Institute of Technology)
Exploratory stochastic dynamics in cellular regulation

- 10:00 - 10:15 **Benjamin Towbin** (Weizmann Institute of Science)
Bacteria use a rule of thumb to make complex decisions
- 10:15 - 11:00 Coffee Break
- 11:00 - 12:30 Quantitative Analysis of Growth
Chair: **Ned Wingreen** (Princeton University)

Peter Swain (University of Edinburgh)
Multiple input pathways mitigate speed-accuracy trade-offs in a MAP kinase signalling network
Ulrich Gerland (Technische Universität München)
Towards dynamic bacterial growth laws

Rami Pugatch
Temporal organization of cellular self-replication
- 12:30 - 14:00 Lunch at Beit Belgia (on Campus)
- 14:30 - 16:00 Evolutionary Aspects of Cell-Cycle Stochasticity
Chair: **Avigdor Eldar** (Tel Aviv University)

Naama Barkai (Weizmann Institute of Science)
Expression homeostasis during S phase
Roy Kishony (Technion, Israel Institute of Technology)
Multi-step adaptive paths leading to high level antibiotic resistance

Lydia Robert (Université Pierre et Marie Curie [UPMC])
Dynamics of mutation accumulation and mutations fitness effects studied at the single cell level
- 16:00 - 16:30 Coffee Break
- 17:15 - 17:30 Transportation to the Israel Museum
- 17:30 - 19:00 Tour of the Israel Museum
- 19:00 - 21:00 Dinner at Modern Restaurant

21:00 - 21:25 Transportation to the hotel

Wednesday, 15 June

09:00 - 10:00 Cell-Cycle Control in Prokaryotes and Eukaryotes
Chair: **Boris Shraiman** (University of California at Santa Barbara)

Ariel Amir (Harvard University)

Simultaneous regulation of size and DNA replication in bacteria: is cell size driver or passenger?

Aaron Dinner (University of Chicago)

Linking bacterial division timing to the mechanics of growing cells

10:00 - 10:20 **Arieh Zaritsky** (Ben-Gurion University of the Negev)

Is nucleoid complexity limited by the eclipse?

10:20 - 11:00 Coffee Break

11:00 - 12:00 Cell-Cycle Control in Prokaryotes and Eukaryotes
Chair: **Naama Barkai** (Weizmann Institute of Science)

Nathalie Q Balaban (The Hebrew University of Jerusalem)

Effect of non linear dynamics on lineage correlations

Johan Elf (Uppsala Universitet)

The coupling of replication and cell division cycles in individual E coli cells

12:00 - 12:15 **Bruno Martins** (University of Cambridge)

The coupling of the circadian clock to dynamic gene circuits and to the cell cycle in cyanobacteria

12:30 - 14:00 Lunch at Beit Belgia (on campus)

14:00 - 15:30

Poster Session

15:30 - 15:55

Transportation to Mahane Yehuda
Tour

15:50 - 19:50

Tour to Mahaneh Yehuda Market. Meet at the IIAS
Lobby at 15:30

Thursday, 16 June

07:30 - 08:30

Early Birds: Visit to the Jerusalem Bird
Observatory
Tour (optional)

09:00 - 10:00

Stochasticity in Decision Making
Chair: **Ady Vaknin** (The Hebrew University of
Jerusalem)

Yigal Meir (Ben-Gurion University of the Negev)
Organizing the bacterial chromosome for division
Ned Wingreen (Princeton University)
Building a biofilm the *Vibrio cholerae* way

10:00 - 10:15

Gilad Yaakov (Weizmann Institute of Science)
Coupling phenotypic persistence to DNA damage
increases genetic diversity under severe stress
conditions

10:15 - 10:30

Michael Assaf (The Hebrew University of
Jerusalem)
Analytical theory of genetic switches and the effect
of extrinsic noise on cellular decision making

10:30 - 11:00

Coffee Break

11:00 - 11:30

Stochasticity in Decision Making
Chair: **Sivan Pearl Mizrahi** (The Hebrew
University of Jerusalem)

- Uri Alon** (Weizmann Institute of Science)
The cellular state at the time of viral adsorption determines the outcome of HSV1 infection
- 11:30 - 11:45 **Parth Pratim Pandey** (University of Delhi)
Reproducing bacterial growth laws, size fluctuations and balanced growth from mathematical models of growing-dividing cells
- 11:45 - 12:00 **Mor Nitzan** (The Hebrew University of Jerusalem)
Revealing regulatory interaction networks from statistics of collective dynamics
- 12:30 - 14:00 Lunch at Beit Belgia (on campus)
- 14:00 - 15:00 Stochasticity in Spatial and Temporal Organization
Chair: **Michael Brandeis** (The Hebrew University of Jerusalem)
- Itamar Simon** (The Hebrew University of Jerusalem)
The mutation spectrum in genomic late replication domains shapes mammalian GC content
- Stas Burov** (Bar-Ilan University)
Stochastic maps as models of cell size
- 15:00 - 15:15 **Jonathan Turner** (Stanford University)
Dilution and phosphorylation of the cell cycle inhibitor Whi5 control cell size in budding yeast
- 15:15 - 15:45 Coffee Break
- 15:45 - 16:45 Stochasticity in Temporal and Spatial Organization
Chair: **Alexander Feigel** (The Hebrew University of Jerusalem)
- Ran Kafri** (University of Toronto)
Negative feedbacks coordinate growth and cell cycle progression to maintain size uniformity in animal cells

Boris Shraiman (University of California at Santa Barbara)

Holographic inference on lineage trees

17:00 - 17:35 **Ariel Amir** (Harvard University)

Closing Remarks

18:30 - 20:00 **Speakers Dinner**

Friday, 17 June

08:00 - 13:30 Tour to Nahal David and Qumran

13:30 - 15:00 Lunch at Ima Restaurant