



Celebrating the 70th birthday
of the State of Israel

The Israel Academy of Sciences and Humanities
cordially invites you to a conference on

לרגל חגיגות שנת ה־70
למדינת ישראל

האקדמיה הלאומית הישראלית למדעים
מתכבדת להזמין אתכם לכינוס בנושא

THE GRAND CHALLENGES IN THE CHEMICAL SCIENCES | JUNE 3-7 2018

Sunday–Thursday, June 3–7, 2018
At the Academy, Albert Einstein Square,
43 Jabotinsky Street, Jerusalem

Organizing Committee: Prof. Raphael Levine (Chair),
Prof. Joshua Jortner, Prof. Dan Shechtman, Prof. Itamar Willner

במים ראשון–חמישי, כ־י"ד בסיוון תשע"ח
7–3 ביולי 2018 בבית האקדמיה
כיכר אלברט איינשטיין רח' ז'בוטינסקי 43, ירושלים
ועדה מארגנת: פרופ' רפאל לוי (יו"ר), פרופ' איתמר וילנר,
פרופ' יהושע יורטנר ופרופ' דן שכטמן

SUNDAY, JUNE 3, 2018

18:00–21:00 Reception and Opening Lecture

Chair: **Zehev Tadmor**, IASH member, Technion – Israel Institute of Technology

Opening remarks **Nili Cohen**, President, The Israel Academy of Sciences and Humanities (IASH)
Raphael Levine, IASH member, The Hebrew University of Jerusalem

Evening Lecture **Joshua Jortner**, IASH member, Tel Aviv University
Chemistry in Israel
A short film: A Journey - Unfinished

MONDAY, JUNE 4, 2018

01
9:45–10:00 **Greetings:**
Nili Cohen, President, The Israel Academy of Sciences and Humanities (IASH)

10:00–11:45 **Session 1 | Drug Discovery**
Chair: **Michael Sela**, IASH member, Weizmann Institute of Science
Richard Lerner, The Scripps Research Institute
The chemistry of large numbers
Ruth Arnon, IASH member, Weizmann Institute of Science
Copaxone: From laboratory polymer to clinical use

Coffee break

02
12:00–14:15 **Session 2 | Chemical & Biochemical Design**
Chair: **Raphael Mechoulam**, IASH member, The Hebrew University of Jerusalem
George Whitesides, Harvard University
Molecular recognition in water is different. The hydrophobic effect, and enthalpy/entropy compensation
Frances Arnold, California Institute of Technology
Engineering by evolution: Bringing new chemistry to life
Arieh Warshel, 2013 Nobel Laureate in Chemistry, University of Southern California
Progress and challenges in rational computer – aided enzyme design

Lunch

03

15:30–19:30 Session 3 | Chemistry and the Science of Materials

Chair: **Helmut Schwarz**, Alexander von Humboldt Foundation

Dan Shechtman, 2011 Nobel Laureate in Chemistry, IASH member, Technion – Israel Institute of Technology
Quasi-periodic materials discovery – The role of TEM

Gabor Somorjai, University of California, Berkeley
Interface materials on the nanoscale. Dominant media of chemical change and evolution

Chair: **David Milstein**, IASH member, Weizmann Institute of Science

Omar Yaghi, University of California, Berkeley

Reticular chemistry

Makoto Fujita, The University of Tokyo

Self-assembly goes far beyond

Ira Weinstock, Ben-Gurion University of the Negev

Structure and reactivity at the interface between molecules and solid-state materials

TUESDAY, JUNE 5, 2018

10:00–12:15 Session 4 | Nano – Science and Molecular Machines

Chair: **Reshef Tenne**, IASH member, Weizmann Institute of Science

Rudy Marcus, 1992 Nobel Laureate in Chemistry, California Institute of Technology
A shot of theory at a biomolecular machine

Sir Fraser Stoddart, 2016 Nobel Laureate in Chemistry, Northwestern University
The rise and promise of artificial molecular machines based on the mechanical bond

Takuzo Aida, Riken Center for Emergent Science; The University of Tokyo

Semibiological robotic nanocarriers responsive to endogenous signals

Coffee break

12:30–13:45 Session 5 | Soft Matter

Chair: **Avinoam Ben Shaul**, The Hebrew University of Jerusalem

Oleg Gang, Columbia University; Brookhaven National Laboratory

Programmable nano-systems: form designed architectures to controllable processes

Jacob Klein, IASH member, Weizmann Institute of Science

Hydration forces, biolubrication and gene regulation: The challenge of osteoarthritis

Lunch

14:45–16:45 Session 6 | Chemistry of the Extremes

Chair: **Nir Davidson**, Weizmann Institute of Science

Ferenc Krausz, Ludwig Maximilian University, Munich; Max Planck Institute of Quantum Optics, Garching
Attosecond physics: from basic research to real-world applications

Albert Stolow, University of Ottawa; National Research Council Canada

Transition states in the excited state: Dynamics at conical intersections

Edvardas Narevicius, Weizmann Institute of Science

Cold chemistry with cold molecules

Coffee break

05

06

07

17:00–19:30 Session 7 | Chemistry on Large Scales**Chemistry of our environment**Chair: **Ronnie Ellenblum**, IASH member; The Hebrew University of Jerusalem**Geraldine Richmond**, University of Oregon

Understanding complex liquid interfaces of environmental importance

Mark Thiemens, University of California, San Diego

The use of isotope effects to understand atmospheres and climates present and past and track the origin of life

Chemistry of the cosmosChair: **Hagai Netzer**, Tel Aviv University**Amiel Sternberg**, Tel Aviv University; Max Planck Institute for Extraterrestrial Physics Munich; Center for Computational Astrophysics Flatiron Institute Simons Foundation, New York City

Cosmic chemistry: From simplicity to complexity

WEDNESDAY, JUNE 6, 2018

08

10:00–11:45 Session 8 | Quantum TechnologiesChair: **Paul Weiss**, University of California, Los Angeles**Dorit Aharonov**, The Hebrew University of Jerusalem

Quantum Physics through the computational lens

Moti Segev, IASH member; Technion – Israel Institute of Technology

Topological photonics

Abraham Nitzan, IASH member; Tel Aviv University

Molecular electronics and plasmonics: Electrons, light and heat transport at the nanoscale

Lunch

09

13:00–14:15 Session 9 | Big Data / Machine Learning and Deep LearningChair: **David Harel**, Vice President, IASH; Weizmann Institute of Science**Naftali Tishby**, The Hebrew University of Jerusalem

The machine & deep learning revolution: How does it change our understating of chemical sciences?

Todd Martinez, Stanford University

How much chemistry can we learn with machine learning?

Coffee break

10

14:15–16:00 Session 10 | Computational & TheoreticalChair: **Rudy Marcus**, 1992 Nobel Laureate in Chemistry; California Institute of Technology**EKU Gross**, Max Planck Institute of Microstructure Physics; The Hebrew University of Jerusalem

TDDFT: Simulating, analyzing and controlling many-electron dynamics, from photovoltaics to laser-driven spin switching

Leeor Kronik, Weizmann Institute of Science

Progress and challenges in the formalism and application of density functional theory

Leticia González, University of Vienna

Molecular photochemistry

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16:00–18:15 Session 11 | Photosynthesis and Energy StorageChair: **Yaron Silberberg**, IASH member; Weizmann Institute of Science**Shaul Mukamel**, University of California, Irvine

Novel spectroscopic probes of photosynthetic charge and energy transfer with quantum and x-ray light

Paul Brumer, University of Toronto

Seeking quantum effects in biological light-harvesting systems

Nathan Nelson, Tel Aviv University

Photosynthetic reaction centers: The engine of life

Greg Engel, University of Chicago

Design principles of photosynthetic light harvesting

Coffee break

18:30 Evening LectureChair: **Moti Segev**, IASH member; Technion – Israel Institute of Technology**Dan Shechtman**, 2011 Nobel Laureate in Chemistry; IASH member; Technion – Israel Institute of Technology

Scientific blunders

THURSDAY, JUNE 7, 2018

12

10:00–11:45 Session 12 | System ChemistryChair: **Yitzhak Apeloig**, Technion – Israel Institute of Technology**Xiaoliang Sunney Xie**, Harvard University

Single cell genomics: When stochasticity meets precision

James Heath, Institute for Systems Biology in Seattle

A molecular view of immuno-oncology

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Coffee break

12:00–14:00

Session 13 | Imaging on the Molecular and Atomic ScaleChair: **Dan Shechtman**, 2011 Nobel Laureate in Chemistry; IASH member; Technion – Israel Institute of Technology**Knut Urban**, Helmholtz Research Center, Juelich

Aberration-corrected electron microscopy: Probing physics and chemistry of matter in atomic dimensions

Wah Chiu, Stanford University

Cryo-EM, an imaging tool beyond crystallography

Shimon Weiss, Bar-Ilan University

Dynamic structural biology: Two decades of smFRET applied to transcription initiation

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Lunch

14:45–17:30

Session 14 | Chemistry of LifeChair: **Raphael Levine**, IASH member; The Hebrew University of Jerusalem**William Schopf**, University of California, Los Angeles

Earth's oldest fossils: Primordial life evolved early, far and fast

Roger Kornberg, 2006 Nobel Laureate in Chemistry; Stanford University

The end of disease?

Ada Yonath, 2009 Nobel Laureate in Chemistry; IASH member; Weizmann Institute of Science

The origin of life, or: What came first the genetic code or its products?

Closing: **Nili Cohen**, President, IASHנא לאשר השתתפות לנב' איביה לוי
aviva@academy.ac.ilPlease confirm participation to Ms. Aviva Levy
aviva@academy.ac.ilמספר המקומות באולם מוגבל. הכניסה על בסיס מקום פנוי. חנייה חיבורית
ברחובות הסמוכים לאקדמיה.On-street parking is generally available in the vicinity
of the Academy.