

The Giovanni Armenise Harvard Foundation 19th Symposium
Visualizing Biology: from the nano to the macro scale
July 10 – 12, 2024
Boston, MA

The 2024 edition of the Giovanni Armenise Harvard Foundation was dedicated to the theme “Visualizing Biology: Structural Biology from the Nano to the Macro Scale”, and took place from July 10th to 12th. After being held for 17 years in different locations in Italy, this time the event became an opportunity to bring the community back where the Foundation started: Boston, the city of Harvard Medical School.

The programme started on the afternoon of July 10th with a welcome by HMS Dean George Daley and an opening keynote by Gaia Pigino from Human Technopole (Milan), who showed the audience her recent work on molecular mechanisms and organisation in cilia, subcellular structures that are of fundamental importance for human health and disease.

“It was an honor for me to be invited to give the keynote” said Pigino. “I described our work in terms of ‘trainspotting’, because in our lab we study molecular trains. These are large machines made of repeating units that move in different directions inside the cilia, organelles that have important functions in many cell types, like motility or signalling. We want to understand how a cilium is built, and how these molecular trains carry all the necessary components to them”.

On the following day, the symposium featured 13 talks including sessions led by some of our Career Development Awardees (Irene Farabella, Mattero Iannacone and Luisa De Vivo), Junior Faculty grantees (Pascal Kaeser, Sean Megason, and top scientists from laboratories in the Boston area (Jeff Lichtman, Rachelle Gaudet, Tomas Kirchhausen, Alexandra Vaccaro, Kwanghun Chung, Fiorenzo Omenetto) and Europe (Alexandra Pacureanu). The presentations showed different examples of how visualization imaging techniques are transforming biology.

Highlights included Farabella showing how chromatin tracing can be used to investigate genome organization at the single-cell level and presented her group’s work on nanoscale imaging of the entire human chromosome 19. Jeff Lichtman stunning the audience with a computationally intensive reconstruction of a cubic millimeter of human temporal cortex that was surgically removed – its 57,000 cells and 150 million synapses transformed into 1.4 petabytes of interactive data. Two talks focussed on imaging the effects of sleep loss in the brain: Luisa De Vivo talked about how sleep deprivation impacts various cell types, causing alterations in gene expression and cell function within neurons, astrocytes, and oligodendrocytes. While Alexandra Vaccaro described the gut as a critical target of sleep regulation, that becomes oxidized and experiences extensive cell death during sleep deprivation, as shown by her work on flies and mice. Matteo Iannacone talked about imaging methods for studying immune surveillance of the liver, while Fiorenzo Omenetto

gave a fascinating overview of how silk and other natural materials can provide inspiration to biochemists to produce materials for electronics, food preservation, energy harvesting, sensors, medical devices.

A poster session showcased research projects by 16 groups, representing many of our CDA awardees in Italy as well as the groups of some of the symposium speakers in the US. On the last day, delegates heard an excellent closing keynote by Ed Boyden from MIT on “Tools for Analyzing and Controlling Biological Systems”, where Boyden showed how one can physically magnify biological samples by synthesizing dense networks of swellable polymer throughout them, and then chemically processing the specimens to swell them. This method, called expansion microscopy, enables ordinary microscopes to do nanoimaging – important for mapping molecules throughout cells, and cells throughout tissues and organs.

The participants also had an opportunity to visit the Harvard Medical School research facilities – including cryo electron microscopy, mouse engineering, neurobiology imaging, mass spectrometry and many others – and discussing new potential scientific collaborations.

The scientific programme was developed with the support of the symposium program co-chairs, Wei-Chung Lee, Associate Professor of Neurobiology at Harvard Medical School and Federico Forneris, Head of the Armenise Harvard Laboratory of Structural Biology at the University of Pavia and Career Development Awardee in 2013.

“I’m beyond amazed at what I’ve seen” Forneris commented after the sessions. “What we managed to combine in terms of talks and discussions, which were an integral part of the session, was a combination of different methodological approaches at different scales and some truly outstanding results regarding observing the cellular components of tissues and the macromolecules that, in turn, constitute these cellular components and how do you act and the nanoscale level”.

For Wei-Chung Lee, “This is a remarkable time in biology because of the technology that we now have. Oftentimes seeing is believing, and now we can comprehensively visualize and map different cell types across tissues, from the macroscale to the nanoscale. In some ways biology is where big physics or astronomy experiments were years ago: we can see much more things than we once could, but we need more and more research to make sense of what we see”.

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PROGRAM

WEDNESDAY, JULY 10, 2024

- 5:00 PM Symposium Registration – Terrace Room Entrance, 3rd floor
- 5:45 PM Welcome and Introduction – Terrace Room
George Daley, Dean, Harvard Medical School; President, Armenise Harvard Foundation
- 6:00 PM Keynote Address
Gaia Pigino, Human Technopole
Cellular structural biology: a powerful approach to reveal the molecular mechanism of cellular processes
- 6:45 PM Welcome Reception – Outdoor Terrace
- 7:30 PM Opening Dinner – Outdoor Terrace

THURSDAY, JULY 11, 2024

All events today held at [Norton's Woods Conference Center](#) at the [American Academy of Arts and Sciences](#), 136 Irving Street, Cambridge, MA

Session 1

Session Title: Nano (Molecules/proteins/channels)

Session Chair: Federico Forneris

20-minute talks plus 10-minute Q&A, 30 minutes total

- 9:00 AM Irene Farabella, Italian Institute of Technology
Walking along an entire human chromosome at the nanoscale
- 9:30 AM Ozge Ozcete, Harvard Medical School
Multiple serotonin release modes under distinct molecular control
- 10:00 AM Jeff W. Lichtman, Harvard University
Visualizing brain: from the nano to the macro scale
- 10:30 AM Coffee Break (30 minutes)
- 11:00 AM Alexandra Pacureanu, The European Synchrotron
X-ray microscopy as a scalable technology to explore life at the nanoscale
- 11:30 AM Rachelle Gaudet, Harvard University
Structural basis of ligand specificity and channel activation in an insect gustatory receptor

12:00 PM	Tomas Kirchhausen, Harvard Medical School <i>Endosomal Escape</i>
12:30 PM	Lunch - <i>West Dining Room</i>
Session 2	Session Title: Macro (Tissue/Organ/Organism) Session Chair: Wei-Chung Allen Lee <i>20-minute talks plus 10-minute Q&A, 30 minutes total</i>
2:00 PM	Sean Megason, Harvard Medical School <i>Formation control between leader and migratory follower tissues allows coordinated growth of zebrafish midline tissues</i>
2:30 PM	Alexandra Vaccaro (Rogulja Lab), Harvard Medical School <i>The biological consequences of sleep loss</i>
3:00 PM	Matteo Iannacone, San Raffaele Scientific Institute <i>Immune surveillance of the liver</i>
3:30 PM	Coffee Break (<i>30 minutes</i>)
4:00 PM	Luisa de Vivo, University of Camerino <i>Uncovering cellular changes in the sleep deprived brain</i>
4:30 PM	Kwanghun Chung, Massachusetts Institute of Technology <i>Illuminating life at multiple scales</i>
5:00-5:30 PM	Fiorenzo Omenetto, Tufts University <i>Living materials – giving unusual shapes to biochemistry by using silk protein</i>
5:45 PM	Poster Session - North Dining Room Wine/Prosecco and Hors d'oeuvres
7:30 PM	Dinner - <i>West Dining Room</i>

FRIDAY, JULY 12, 2024

	Department Engagement (Junior Faculty Grantees and CDAs) Opening Session: Caroline Shamu, Cannon Classroom, Bldg C, Rm 135 Core facilities website: https://corefacilities.hms.harvard.edu
9:35 AM on	One-to-one meetings (CDAs) in HMS departments – see <i>personalized agenda</i>
12:00 – 5:00 PM	Breakout room available (Tosteson Medical Education Center, TMEC), Rm 144, Student Orientation Room. Can be used for Zoom meetings or to leave luggage.
12:30 – 2:30 PM	All Symposium Delegates Symposium Closing Keynote (Gordon Hall, Waterhouse Room, HMS) Ed Boyden, Massachusetts Institute of Technology <i>Tools for Analyzing and Controlling Biological Systems</i> Symposium Closing Lunch: (Gordon Hall, Waterhouse Room, HMS)