
IMBA
IMBA 2025
RESEARCH
REPORT
ÖAW
Austrian
Academy of
Sciences
Part of
Vienna
BioCenter

About the new IMBA logo

A logo is a small object asked to carry a large institutional story. IMBA's new mark does this through each letter: four characters whose surfaces are broken by the branching lines of cell membranes, turning the name of the institute into a living thing.

The story of how it came to be is worth reading.

Learn more at imba.ac.at/rebranding

About the kaleidoscope visuals

In 2025, the goal for the art direction built on the creativity of previous research reports: turning scientific data into a visual language that invites curiosity at the point where objective data meets human perception.

A kaleidoscope creates rhythm from one fragment, drawn from research group diagrams, fluorescence microscopy, and model organisms, which is mirrored time and again to produce predictable cycles of symmetry, like petals around a center, triangular wedges, or rotating star patterns.

You will see this repetition of geometric shapes and colors throughout the report.

Download all kaleidoscope designs as mobile and desktop wallpapers.

imba.ac.at/downloads

EXPLORING THE UNKNOWN

Content

1. A first look at IMBA

10 What's special about this report?
A reflection of a year, a comprehensive inventory of milestones passed and challenges met. This would be a traditional annual report; but this is not what you are holding in your hands.

12 A conversation with the directors
For the 2025 Research Report, we spoke with IMBA directors Barbara Kraus and Elly Tanaka about what stays the same when everything else is changing.

14 IMBA at a glance
With 12 research groups and one joint IMBA/IMP research group, world-class experts in scientific and other services, and outstanding infrastructure, IMBA is aligned with a passion for discovery and commitment to science.

16 Three pillars for sustaining world-class science
Ulrike Diebold has spent her career in surface physics, but as Vice President of the Austrian Academy of Sciences (ÖAW), she now thinks about a different kind of structure.

2. The science we pursue

24 Small steps, big questions
Research teaches a counterintuitive lesson: sometimes slowing down is the fastest way forward.

28 A year of discovery
In 2025, IMBA researchers published more than 80 research papers. Some highlights of the year showcase the diversity of research in IMBA's portfolio.

34 Behind the image
Three IMBA researchers opened the door mid-experiment and shared what they couldn't wait to show someone.

36 Research groups
In 2025, scientists at IMBA worked together in 12 research groups and one joint IMBA/IMP research group, often tackling scientific challenges in collaborations across single labs or institutes.

51 Our services
Collective support and shared expertise from scientific facilities, administration, and other services make an essential contribution to research at IMBA.

3. 2025 in review

56 Building the future

57 The space between intuition and proof
Elly Tanaka's Wittgenstein Award, Austria's leading research prize, isn't just recognition. It provides the freedom to pursue the kind of exploratory work that traditional grants would not support.

60 The courage to be wrong 80 percent of the time
After receiving an Advanced Grant from the European Research Council, Sasha Mendjan asks his team for a commitment to pursue research where most attempts fail.

62 Wisdom, borrowed and otherwise
The IMBA community shared quotes that define how they think and work. From the profound to the profane, no one held back.

64 Behind the scenes of funding acquisition
One applicant shares what the final hours of a grant deadline actually look like from the inside.

68 Unpacking the lab—and the questions
New Group Leader Kristina Stapornwongkul explains what happens before the first experiment.

70 Connecting with society

70 Outreach
IMBA engages with society through outreach programs, education initiatives, and dialogue with partners across science, politics, and industry.

78 Science meets classroom
Helena Okulski brings regeneration research to Vienna's primary schools through neugierige.köpfe, an outreach initiative she launched at IMBA that transforms participating scientists in the process.

80 Only when everyone's in the room
The Health Science Forum, a cooperative partnership between IMBA and Merck Austria, creates rare dialogue between researchers, pharma, policymakers, and patients, proving that complex science calls for collaborative conversations.

82 The questions they didn't plan for
At the Daughters' Day event at the Vienna BioCenter in April, the best-laid plans gave way to something better: authentic dialogue leading to lasting connections.

86 Activity: Ensuring safe research
87 The Scientific Advisory Board
88 Imprint

01

A FIRST LOOK AT IMBA

The olfactory epithelium in the nasal cavity initiates odorant detection. Olfactory sensory neurons located in this epithelial layer (blue, DAPI) bind chemical odorants and convert chemical stimuli into electrical signals sent to the brain via nerve bundles (green, DCX).

OISORJO CHAKRABORTY, GRADE LAB

What's special about this report?

A reflection of a year, a comprehensive inventory of milestones passed and challenges met. This would be a traditional annual report; but this is not what you are holding in your hands.

What you are holding in your hands is the endpoint of a year-long process that brought people together. People at IMBA, at the IMP, in services shared by these two and other organizations. Peers, stakeholders, partners. In short, the people who care about IMBA and its mission.

When this project was started, its goal was not to create a traditional annual report that some external readers flick through once and then throw away. This report focuses on the many people who truly care about IMBA—and they were actively involved in creating it.

Lists and dry data were largely moved to our website—you will find them via QR codes. This freed up space. Space that was given to magazine-style stories, suggested by the community through surveys and actions on campus. The photography centers on people and was developed through a series of events. A journalist visited a social hour to prepare to capture the spirit of the campus. Interviews involved colleagues from all trades and backgrounds, from the directors and the ÖAW Presidium to wild potpourris of quotes that gave everyone a chance to be heard. Feedback was collected in several stages and in diverse focus groups.

The journey that led to this publication drew from many people and was at least as important as the final product. Collaborative, determined, fun. A process that reflects the essence of this campus—the people who breathe life into it.

Left to right: Niccolò de Marzo, Sabrina Villar Pazos, Samuele Maturi, Martina Beccari, Tereza Oppelt Duranova, and Petra Schaffer.

A conversation with the directors

For the 2025 Research Report, we spoke with IMBA directors Barbara Kraus and Elly Tanaka about what stays the same when everything else is changing.

What's the essential secret of IMBA?

Barbara Kraus: I think what really defines IMBA is that we care deeply about quality in everything we do. It's not about perfection for its own sake but about creating an environment where people feel supported to do their very best science. If we manage that, excellence comes almost naturally. For me, the most important driver in all of this is curiosity. If you stay curious, it carries you through the difficult phases.

Elly Tanaka: And we have the freedom to perform science at the highest level with few distractions, remarkable scientific and technical facilities, and no boundaries between groups, so collaborations thrive. That means we can aim high and answer the most profound questions in biology. But high standards don't prevent people from having fun. One image that comes to mind is the cafeteria where people are having coffee and laughing. IMBA is a place where people enjoy being here because they have the freedom to explore what they want.

How does IMBA enable that kind of research in practice?

Elly Tanaka: What's remarkable about the institute is how rapidly things can be decided and implemented. We benefit from very short paths of communication and decision-making.

Barbara Kraus: Our goal in administration is to remove as many obstacles as possible so that students, postdocs, and group leaders can concentrate on their research. Many PhD or master's students don't even notice the administration in their daily work here, and I take that as a compliment.

Science culture is changing. How is IMBA responding?

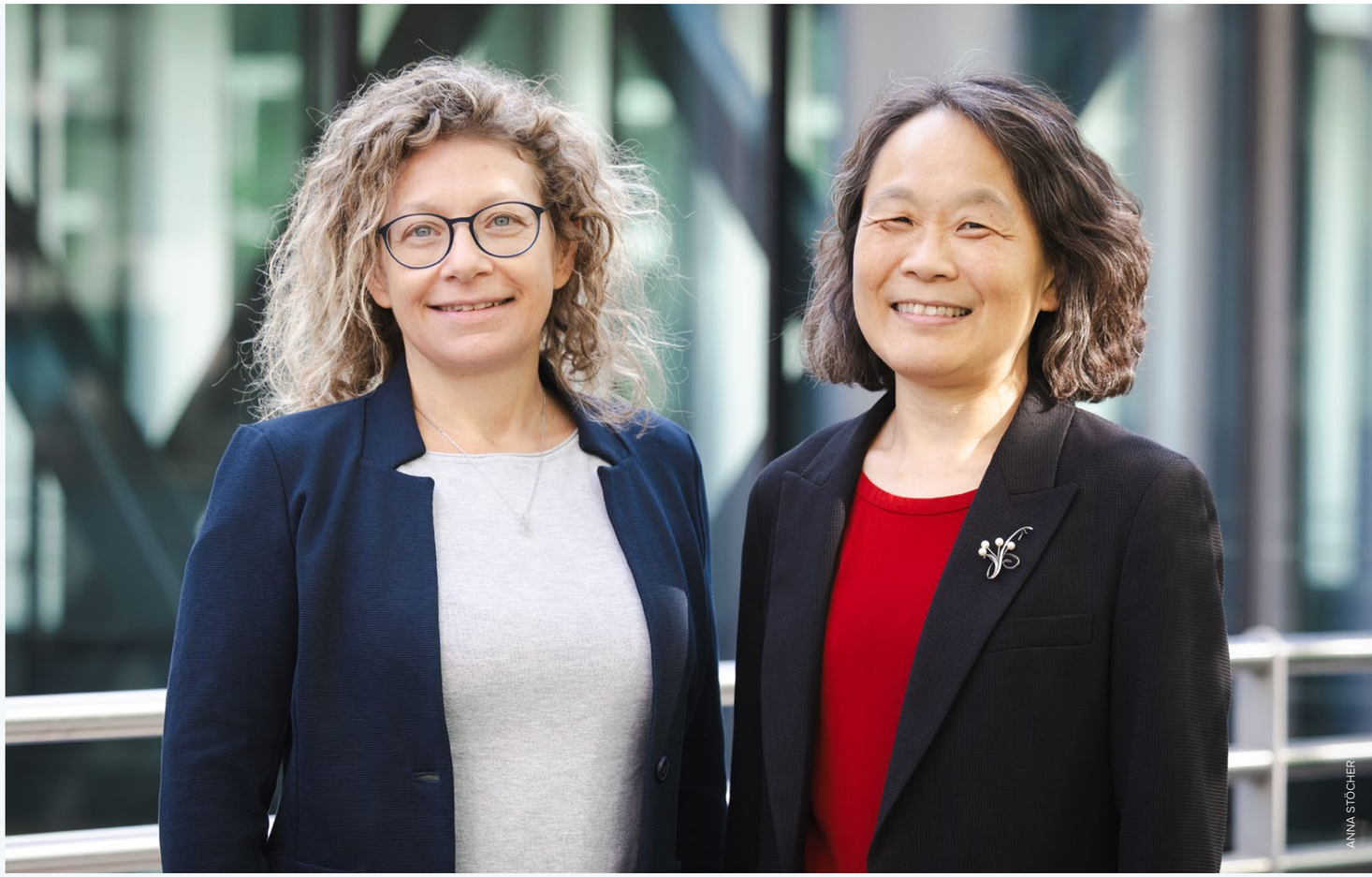
Barbara Kraus: Having two women as directors is certainly a visible cultural change, and I see that it resonates with many colleagues. At the same time, I hope it also sends a broader signal: that there are many different ways to be a scientist and a leader here, and that diverse voices are not only welcome but needed. In 2025, we also developed a new logo to mark this turning point. When we asked the community what best describes the purpose of IMBA, two answers emerged: to increase knowledge and to push boundaries. The new logo reflects these values by putting the science inside the name. One that could only belong to a molecular biology institute.

What's changing scientifically, and how is IMBA responding?

Elly Tanaka: In the past, biology relied on reductionist ways of studying the world. We were satisfied if we identified a single gene or protein whose function contributed to a process, thinking that A plus B equals C. But we now know that intracellular processes involve hundreds or thousands of components with complex interdependencies. One single factor cannot explain much. Learning to understand this complexity conceptually and in more detail is fascinating and important.

Barbara Kraus: We've just recruited Daan de Groot, a mathematical biologist, as a new group leader, building on the strong expertise in modeling we already have here. Tools like AlphaFold are now part of everyday life in many groups, and we have our own high-performance computing cluster to support this work. We are also planning to build collaborations with AITHYRA, the new AI institute at the Vienna BioCenter. The exciting vision is to connect the deep biological knowledge that already exists with questions that previously seemed out of reach because we lacked computational power.

Elly Tanaka: Right, and with computational power, we can now take into account bigger and bigger datasets. But just describing these datasets is not the objective. AI will come up with interesting connections, but bringing that down into a meaningful mechanism or a conceptual insight with an incisive scientific result is something that researchers at IMBA are extremely good at.



ANNA STÖCHER

Barbara Kraus | Administrative Director
Elly Tanaka | Scientific Director

Looking ahead, what matters most for IMBA's future?

Barbara Kraus: The most important choices are the colleagues that we choose. Whether they have strong curiosity for discovery and truth, whether they are giving, community-oriented people who can see the big picture as well as the finest detail.

IMBA at a glance

With 12 research groups and one joint IMBA/IMP research group, world-class experts in scientific and other services, and outstanding infrastructure, IMBA is aligned with a passion for discovery and commitment to science.

The Institute of Molecular Biotechnology (IMBA) is one of Europe's leading basic research centers in molecular biology and biomedical science. As a research institute of the Austrian Academy of Sciences and a key part of the Vienna BioCenter, IMBA is a central pillar of a dynamic, international life science hub.

The Vienna BioCenter brings together research institutes, universities, and biotech companies, creating a thriving environment where fundamental and applied research intersect with education to drive scientific progress. All of this takes place in the vibrant environment of Vienna—one of the world's highest-ranked cities for quality of life.

KEY FIGURES*

263
people

12
research groups
+ 1 joint IMBA/IMP
research group

40
countries

80+
publications
in 2025

4
Wittgenstein
Awards

25
ERC grants

* as of 31 December 2025

Research

Scientific curiosity and a commitment to excellence drive IMBA researchers to tackle challenging questions, pioneer new fields, and advance our understanding of life at the molecular level. Research topics pursued at IMBA span diverse areas, including RNA biology, chromosome biology, neurobiology, stem cells, regeneration, organoid research, and disease modeling. IMBA encourages collaboration across research groups and institutions.

IMBA and its scientists benefit from core funding provided by the Austrian Academy of Sciences. Additionally, researchers successfully secure third-party funding from national and international funding agencies. These resources give IMBA scientists the flexibility to explore bold new research directions, develop cutting-edge technologies, and establish innovative model systems. IMBA's ambition is to make great leaps, rather than to take incremental steps.

Education

The foundation of IMBA's future success is its community of young scientists, who are guided toward research excellence through world-class training programs. As a top destination for researchers at all career stages—from interns to PhD students and postdocs—IMBA plays a key role in shaping the next generation of scientific leaders.

The Vienna BioCenter's internationally renowned doctoral and postdoctoral programs are integral to IMBA's educational mission. These programs provide rigorous training that fosters scientific independence and leadership skills, ensuring that researchers are equipped to tackle the challenges of the future.

Work culture

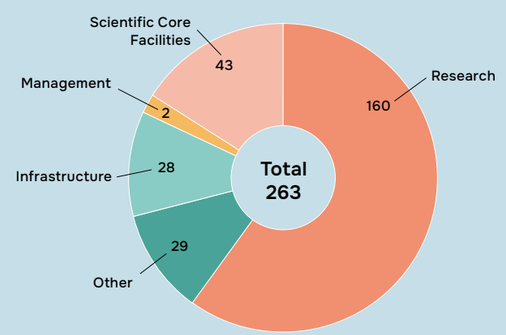
A positive work culture is a substrate for creativity and innovation. As a research institute driven by fresh ideas, IMBA endorses diversity and is committed to fostering a supportive, collegial, and inclusive work environment where all employees can thrive and contribute to high-impact research. The institute champions scientific excellence while ensuring a workplace culture that values collaboration, integrity, and diversity.

To maintain the highest research standards, IMBA undergoes an annual evaluation by the Scientific Advisory Board, which is composed of independent international experts. The Scientific Advisory Board provides guidance to the institute's leadership and the Austrian Academy of Sciences, ensuring that IMBA continues to uphold its reputation as a global leader in molecular biology and biomedical research.

STAFF BY FUNCTION

IMBA's achievements are powered by a diverse, international team of scientists, technical experts, and professional support staff.

Data as of 31 December 2025



Step inside the labs: Watch the video to see how research at IMBA turns ideas into insights.

Three pillars for sustaining world-class science

Ulrike Diebold has spent her career in surface physics, but as Vice President of the Austrian Academy of Sciences (ÖAW), she now thinks about a different kind of structure.

ÖAW/HINTERRAMSKOGLER

The ÖAW oversees more than two dozen research institutes. When Vice President Ulrike Diebold describes what ties them together, she names three principles:

> **"Discovering the future, performing research, representing science. These are our key values."**

Diebold is a member of the ÖAW's presiding committee and a professor at the Institute of Applied Physics, Vienna University of Technology, where her research on the atomic-scale properties of metal-oxide surfaces earned her the Wittgenstein Award. From her position on the ÖAW Presidium, she has direct insight into how the Academy sets expectations for its institutes and works to support them.

Ulrike Diebold | Professor of Surface Science at the Institute of Applied Physics, Vienna University of Technology, and ÖAW Vice President since 2022

Pillar 1: Discovering the future

One measure of a research institute is its scientific output. Another is what happens when that research moves beyond the lab. IMBA's position within the Vienna BioCenter places it at the intersection of both.

The boundary between basic research and applied science is often described as rigid. How does IMBA challenge that assumption?

Ulrike Diebold: I very much welcome the permeability of that imaginary wall. IMBA is one of the leading life sciences institutes in Europe, and it demonstrates how basic research and industry can reinforce each other.

Researchers from IMBA have founded six spin-off companies that hold licenses for intellectual property developed at the institute, and IMBA technologies have been licensed to industrial partners including Stemcell Technologies and Lexogen. The institute actively pursues these opportunities through framework agreements with partners like the KHAN Technology Transfer Fund, which invests in early-stage life science ventures, and wings4innovation, an Austrian funding program for translational research.

6 **spin-off companies founded by IMBA researchers, based on intellectual property developed at the institute**

The ÖAW supports this at the institutional level. The Academy has developed a Spin-off Guideline for researchers who want to turn their discoveries into companies and has built a network of investors interested in early-stage ventures. The Presidium also advocates at the policy level, securing access to government funding that was previously unavailable to ÖAW institutes. And researchers at IMBA can attend entrepreneurship programs like xbio, which helps scientists navigate the journey from lab to market.

Pillar 2: Performing research

Strong research depends on strong support. Diebold explains the model the ÖAW uses to give its researchers the freedom to pursue ambitious questions.

What does IMBA need to sustain ambitious, long-term research?

Ulrike Diebold: IMBA's strength lies in its commitment to curiosity-driven basic research, where researchers are encouraged to ask bold and sometimes unconventional scientific questions. But that kind of research takes time and focus, which is why the ÖAW works to remove as many distractions as possible.

Strong core funding is part of this. It removes the pressure to chase third-party money at the start of a group, which gives researchers the space to tackle larger scientific questions. The central administration also provides robust support with grants and communications, not just bookkeeping, so researchers can spend their time on science rather than paperwork.

> **"Research takes time and focus, which is why the ÖAW works to remove as many distractions as possible."**

Diebold has seen this firsthand. When she received the Wittgenstein Award, Austria's most prestigious science prize, she used it to build new capabilities.

The award made it possible to build a new laboratory, and we can now image surfaces and molecules with unprecedented precision and probe nature in ways that were not possible previously.

Pillar 3: Representing science

How science is communicated shapes how people see it. And who communicates it shapes how people imagine who belongs in the field.

What does it mean for ÖAW institutes to represent science publicly?

Ulrike Diebold: The ÖAW and its institutes are unique in Austria. In addition to pursuing scientific excellence, we aim to contribute our voice to important public debates. We share our expertise, and in return, we expect decisions to be evidence-based. We not only conduct science, we communicate it. That is what the presiding committee does, and it is what we expect from all of our institutes.

> **"Most of the researchers in this program are women, which shapes how young people imagine who can do science."**

You can see this at IMBA in initiatives such as the Vienna Open Lab, established in 2006 as a joint effort of IMBA and OpenScience. The outreach activities at Vienna Open Lab bring school students and the public into direct contact with scientific research. The ÖAW's FÄKT project takes a similar approach, using short-format videos to make science accessible to kids and young adults. Most of the researchers in this program are women, which shapes how young people imagine who can do science. A film clip on regeneration research at IMBA is scheduled for next year.

What steps is the ÖAW leadership taking to ensure women are also represented in research at the highest levels?

Ulrike Diebold: Many of our institutes are already led by women who serve as strong role models, from the life sciences with Elly Tanaka as Scientific Director of IMBA and Maria Rescigno as Director of CeMM, to Francesca Ferlaino, Scientific Director at the Institute for Quantum Optics and Quantum Information, and Christiane Helling, Director of the Space Research Institute. This extends to the presiding committee, where 50 percent are women, all demonstrating what leadership in science looks like.

But visibility is only part of it. The ÖAW has an equal opportunity plan; gender and diversity lectures; and public outreach activities that put women in the spotlight. Practical support matters, too. Pregnancy labs, designed to protect pregnant researchers and unborn children from chemical, biological, and radiation hazards, allow researchers to continue their work safely during pregnancy, which makes a meaningful difference and sends an important signal to politics and society.

What is the most important piece of advice you offer women navigating bias in a traditionally male-dominated field?

Men are not better just because they speak out louder. Trust yourself, and never say no to a job offer simply because you think you might not be able to do something. You are!

This interview with Ulrike Diebold was edited for print. Enjoy the full conversation with Ulrike Diebold.

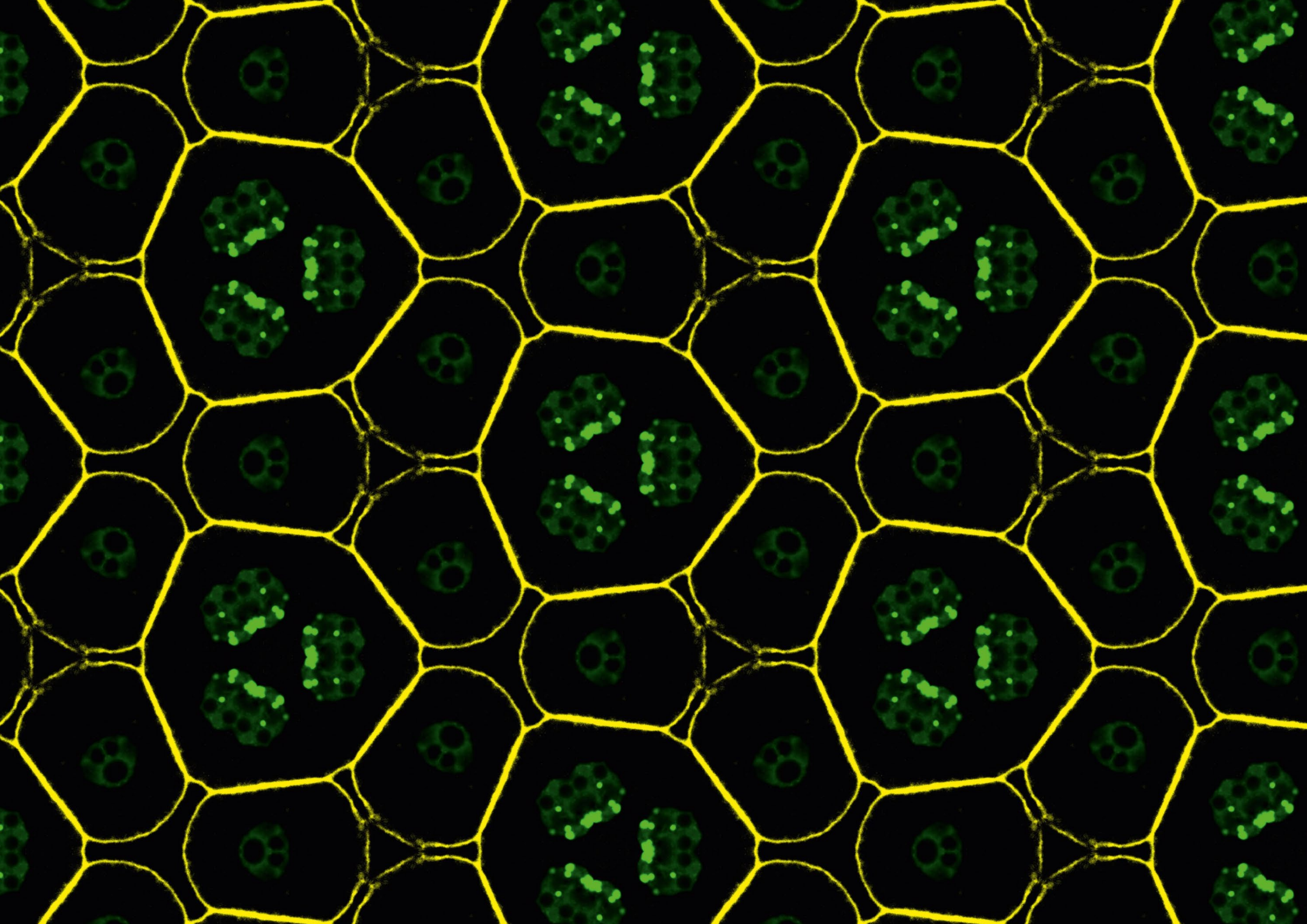
ÖAW AUSTRIAN ACADEMY OF SCIENCES

Austrian Academy of Sciences

"Discovering the future since 1847" is the claim of IMBA's umbrella organization, the Austrian Academy of Sciences (ÖAW). At its core, the Academy is two things: a 760-member learned society and a research organization with 26 institutes across Austria. Three of these institutes are at the Vienna BioCenter: IMBA, GMI, and AITHYRA. ÖAW researchers benefit from awards, fellowship programs, and scientific services ranging from libraries to publishing to conference management. The ÖAW employs 1800 people.

The Presidium is the Academy's governing board and supreme executive body. Alongside Vice President Ulrike Diebold, the current presiding committee includes President Heinz Faßmann and Division Presidents Christiane Wendehorst and Wolfgang Baumjohann.

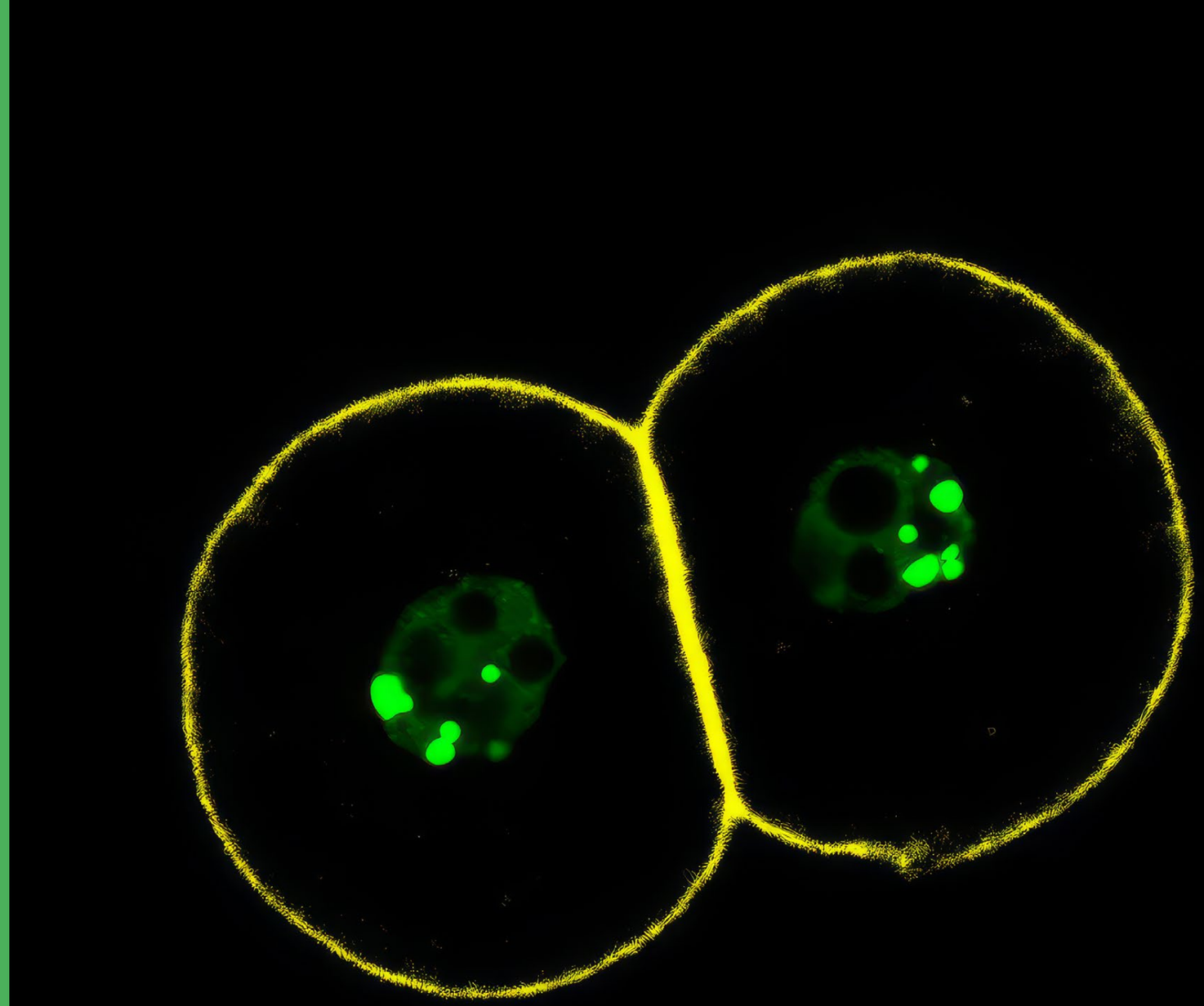
Discover the Austrian Academy of Sciences and its research institutes: www.oeaw.ac.at



02

THE SCIENCE WE PURSUE

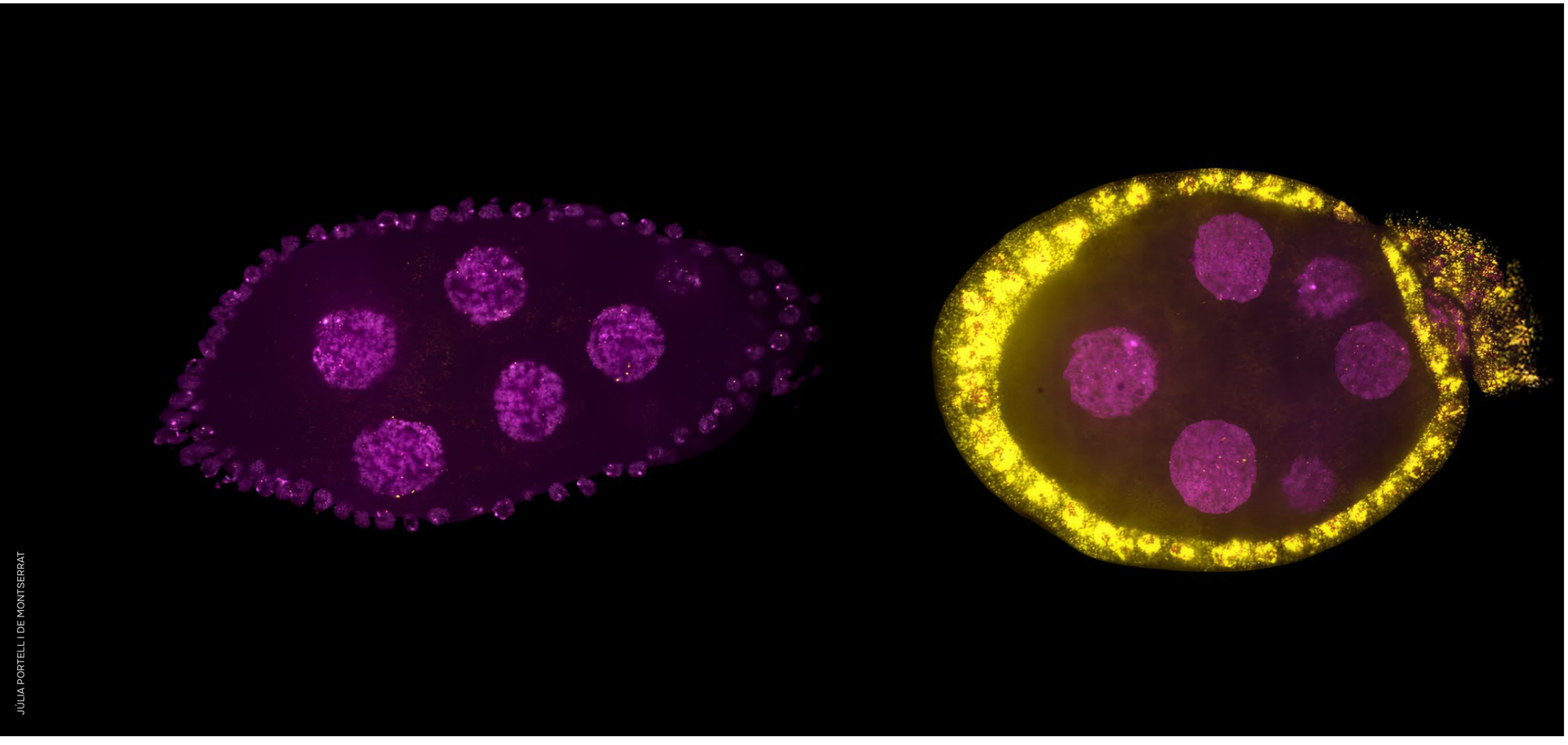
A 2-cell mouse embryo injected with iCRUSH (CRISPR-based system) targeting major satellite repeats. The image shows dCas9 (green) and injector marker membrane-mCherry (yellow).



ANTONIO DOCAVO GARCIA, JACHOWICZ LAB

Small steps, big questions

Research teaches a counterintuitive lesson: sometimes slowing down is the fastest way forward.



JÚLIA PORTELL I DE MONTSERRAT

Transposon expression (yellow) is silenced by PIWI in *Drosophila* ovaries (left), but activates in the absence of Piwi and its partners (right).

Group Leader Julius Brennecke knows himself well. “I’m a critical person,” he admits. He likes to challenge approaches, question ideas, and push ahead. For three years, Júlia Portell i de Montserrat’s PhD project demanded something else: systematic patience and small, controlled steps. The biggest lesson both of them learned on the project, published this year in the journal *Molecular Cell*, came down to a principle that’s easy to forget and hard to practice: “fast is slow and slow is fast.”

The question they couldn’t escape

Portell’s project focused on understanding how transposons, mobile genetic elements that can damage genomes, get silenced in the nucleus through the piRNA pathway. “We knew that this mechanism exists,” Brennecke explains. “We just didn’t know what the protein complex looks like or how it works mechanistically.”

The original plan seemed ambitious yet straightforward: purify the protein complexes, determine what interacts with what biochemically, get the cryo-EM structure. Modern structural biology.

But for two to three years, as Brennecke describes it, they were “hammering at approaches” that wouldn’t yield results. Things were working, Portell remembers, “but never well enough.” The proteins wouldn’t cooperate. The structure wouldn’t emerge. They were stuck.

The mentorship tightrope

“At this point, everybody was starting to get nervous,” Brennecke admits. “It’s not just the student who thinks, ‘Oh no, my entire PhD will go down the drain.’ I was also having sleepless nights. As a supervisor, you constantly have to ask yourself: how do you install trust in a certain approach, but don’t pursue it too long? At some point, you have to pull the plug.”

Brennecke’s natural instinct is to challenge approaches constantly. “If you question the approach every time while it’s still ongoing, it’s discouraging for students. They start to wonder if what they’re doing is still worth it.”

> **“When I started, I would have doubted most of my experiments even if they were conclusive. Maybe I did something wrong or I just got this result randomly. So that’s something you learn through the PhD.”**
>
> **Júlia Portell i de Montserrat, IMBA/IMP**

This is where Portell’s unusual arrangement became crucial. She divided her time between Brennecke’s genetics lab at IMBA and Clemens Plaschka’s structural biology lab at the IMP. “Clemens is a top-level structural biologist,” Brennecke says, and his contribution helped balance the critical questioning while bringing essential expertise to the project.

“In general, we tried to answer the problem in a very mechanistic way,” Portell explains. Plaschka’s expertise in mechanistic RNA biology, specifically on the spliceosome and the splicing cycle, helped them think about how things might work in the piRNA pathway. “Although the players are different, there are quite some conceptual similarities.”

Portell benefited from being part of both groups. “Seeing how people in the Plaschka lab thought and approached their projects helped me a lot in mine,” she says. Even during the difficult year when nothing worked, she felt supported. “I never felt like they were doubting what I was doing.”

A new tool, a new path

After years of partial success, they developed a strong strategy. “What I learned throughout this is to focus on the small steps, but do them in a very controlled manner,” Brennecke explains. “So that at the very least you can conclude something. Even if it comes to the conclusion ‘this does not work,’ you want to be sure it doesn’t work and it’s not because we left something out.”

Then AlphaFold arrived. In July 2021, the AI-powered protein structure prediction database was officially launched, containing predictions for nearly all known proteins.

> **“What I really take out of the project is that you have to ask big questions. I’m convinced you can get to almost any answer. It’s only a matter of time.”**
>
> **Julius Brennecke, IMBA**

“AlphaFold is a game-changer for everybody who understands how to use it,” Brennecke says. “And that’s exactly what happened. With Clemens and Júlia and our insight and knowledge in the field, we could finally move forward.”

Instead of chasing the structure using experimental methods, the scientists could generate hypotheses and test them first in silico before doing genetic experiments in cell lines or flies. “From there on, we shifted, and it was amazing,” Brennecke says.

The shift in methods initially worried Portell. “When I started the project, I knew a lot more about biochemistry than genetics,” she says. But the small, controlled experiments finally provided definitive answers. “Being able to design the experiment and getting it to work, which hadn’t been the case for a while, was nice.”

Small, controlled steps

“What I really take out of the project is that you have to ask big questions,” Brennecke reflects. “I’m convinced you can get to almost any answer. It’s only a matter of time.”

For Portell, one of the most important lessons was learning to trust her own work. “When I started, I would have doubted most of my experiments even if they were conclusive,” she admits. “Maybe I did something wrong or I just got this result randomly. So that’s something you learn through the PhD.”

Brennecke sees this confidence as essential. “If you don’t trust yourself sufficiently, then you will have such a hard time troubleshooting because you always take it personally. But if you trust yourself, you can focus on these small steps towards the big-picture vision.”

The eager supervisor and the anxious student both learned the same lesson from opposite sides: big questions require small steps. Systematic beats frantic. Trust enables risk. Sometimes the longer path is actually the fastest way to get there.

PUBLICATION

Portell-Montserrat, J., Tirian, L., Yu, C., Silvestri, G., Hohmann, U., Handler, D., Duchek, P., Fin, L., Plaschka, C., & Brennecke, J., Target RNA recognition drives PIWI* complex assembly for transposon silencing. Molecular Cell, 4 September 2025. DOI:10.1016/j.molcel.2025.08.007

ACKNOWLEDGMENTS

Papers encompass teamwork beyond authors. While there were additional contributions beyond the campus, the focus here is on the Vienna BioCenter. For this study, the authors would like to acknowledge in particular the contributions of Peter Duchek, head of the Fly and Worm facility, and his team, who generated the challenging CRISPR-edited flies that enabled Julia to demonstrate the validity of her model in vivo, as well as the Vienna Drosophila Resource Center for fly stocks and the IMP IMBA GMI Proteomics Facility, BioOptics, and High Performance Computing Cluster for their outstanding support.

Explore this and other IMBA research papers: www.oeaw.ac.at/imba/publications

ADAM COOPER

Júlia Portell i de Montserrat successfully defended her PhD this year. Team members from the Brennecke and Plaschka labs celebrated with her on the occasion.

How PIWI proteins silence transposons

Transposons, often called “jumping genes,” are mobile genetic elements that can damage the genome if left unchecked. To protect genome integrity, especially in reproductive cells, organisms rely on the PIWI–piRNA pathway. In this study, researchers at the Vienna BioCenter solved a long-standing question in the field: how PIWI proteins initiate transposon silencing. They discovered how PIWI proteins become active in silencing, only after binding to a target RNA. Target RNA recognition triggers the recruitment of partner proteins and the assembly of a silencing complex that shuts down transposons.

The findings are the result of a collaboration between the labs of Julius Brennecke at IMBA and Clemens Plaschka at the IMP, combining AI-based protein structure prediction with biochemistry and genetics to describe the first steps of PIWI-mediated transposon silencing.

For Plaschka, the study clarifies a molecular process that had remained unresolved: “The key players for PIWI-based silencing had been identified by genetics over the past decades, but how these factors come together at the molecular level and control silencing had remained unclear. Our work revealed the initiating steps of transposon silencing by PIWI, setting the stage for future molecular studies. We bridged from whole organisms to atomic interfaces by joining forces across the Brennecke and Plaschka labs.”

The study shows that genome defense is tightly controlled: silencing is only activated when needed, ensuring both precision and protection against harmful mutations.

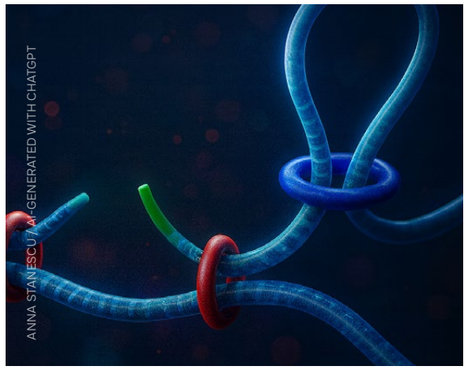
A year of discovery

In 2025, IMBA researchers published more than 80 research papers. Some highlights of the year showcase the diversity of research in IMBA's portfolio.

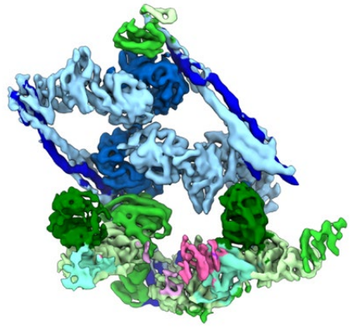
Broken DNA's missing match: How cohesin guides DNA repair

When DNA breaks, cells face a daunting challenge: finding the exact matching sequence needed for accurate repair within a genome folded into a dense, three-dimensional maze. Although many of the molecular players in this process were known, scientists did not understand how a broken DNA end actually **finds** its matching sequence inside the densely folded nucleus.

A 2025 study from the Gerlich lab at IMBA revealed the missing link. Using their newly developed Sister-pore-C technique, which maps contacts between sister chromatids at high resolution, the team discovered that the protein cohesin orchestrates the homology search. They showed that cohesin operates in two coordinated modes: one reshapes surrounding chromatin by enlarging loops to define the search region; another anchors the broken DNA end to its sister copy. Together, these mechanisms transform a daunting genome-wide quest into a focused and efficient search within the nucleus.



ANNA STANESCU / AI-GENERATED WITH CHATGPT



ULRICH HOHMANN, BRENNECKE & PLASCHKA LABS

Completing the puzzle of mRNA export from the nucleus

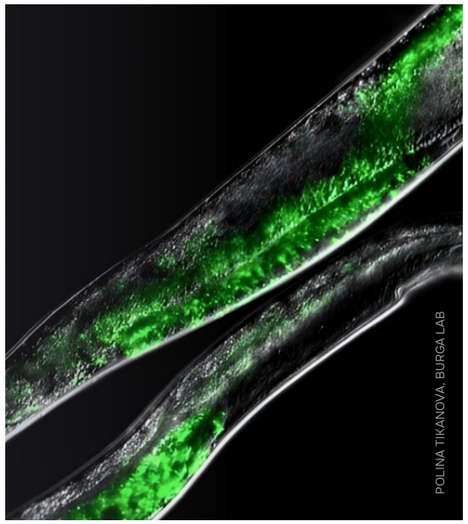
To build proteins in the cytoplasm, the necessary genetic instructions must first get out of the nucleus where they are stored. Transportation of these instructions, encoded in messenger RNAs (mRNAs), is one of the most fundamental processes in gene expression. Over the past 30 years, most of the factors involved in this process have been described, but scientists did not understand how they are orchestrated together to integrate the packaging of mRNA molecules with their exit from the nucleus.

A study by researchers in the Brennecke lab at IMBA and the Plaschka lab at the IMP put known puzzle pieces together to form a comprehensive big-picture view of mRNA export. Combining advanced cryo-electron microscopy (cryo-EM), AI-based protein modeling, and biochemical and cellular assays, the team revealed that the protein UAP56 guides mRNAs through their nuclear packaging and remodeling into export-ready particles, ultimately delivering them to the nuclear pore for export.

How good genes became selfish

Toxin-antidote elements (TAs) are selfish genetic sequences that are perpetuated by poisoning those embryos that do not inherit them. These genetic pairs encode for a toxin and its antidote, posing a chicken-and-egg question about their evolutionary origin. In 2025, scientists in the Burga lab showed how selfish toxin-antidote elements evolved from normal cellular proteins.

Studying the nematode worm *C. tropicalis,* the team discovered that the toxins in three different toxin-antidote elements evolved from a duplicated enzyme gene, phenylalanyl tRNA synthetase, which gained a new, toxic function. In addition, the team proved that the respective antidotes evolved from F-box proteins that target other proteins for degradation. The scientists showed that the original F-box proteins could already interact with the new toxins, allowing toxin and antidote to coevolve into a novel toxin-antidote element.

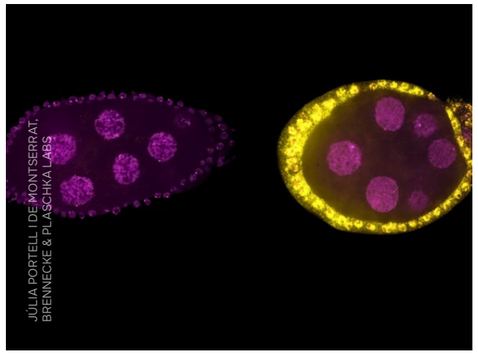


POLINA TIKANOVA, BURGA LAB

Boosting protein research with new mass spectrometry technology

Cross-linking mass spectrometry allows scientists to freeze-frame and study protein interactions. However, this approach is limited by its sensitivity—many important interactions are too rare or too weak to detect, because their signals are easily drowned by more abundant peptides.

Using the new Orbitrap Astral mass spectrometer, researchers at the Proteomics Tech Hub developed an improved protocol able to identify 40 percent more crosslinks from the same samples. This allows scientists to identify and explore protein connections to an unprecedented level, detecting previously unseen surface interactions and even rare connections buried deep within the proteins themselves.



JÚLIA PORTELL I DE MONTSERRAT, BRENNECKE & PLASCHKA LABS

The beginning of the end: Vienna Bio-Center collaboration reveals how PIWI proteins protect animal genomes

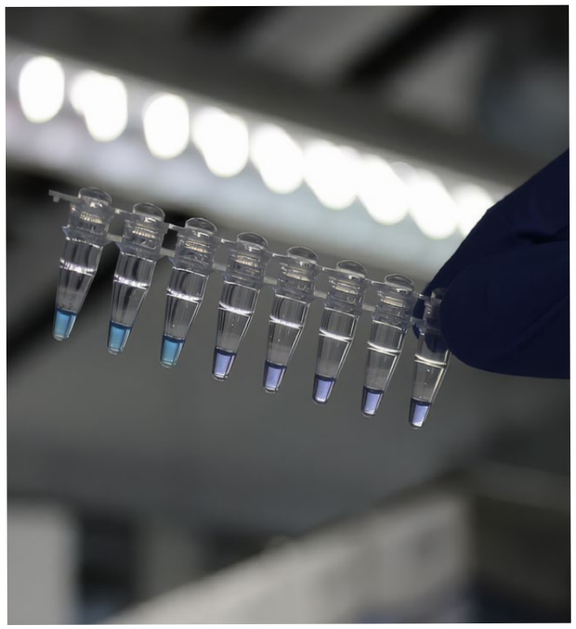
A collaboration between the labs of Julius Brennecke at IMBA and Clemens Plaschka at the IMP uncovered a molecular centerpiece of the PIWI-piRNA pathway, the cell's main defense against "jumping genes." The team combined AlphaFold-based modelling of protein-protein interactions with genetics, biochemistry, and cell biology to identify the first steps of silencing that occur once a PIWI protein engages with a transposon sequence.

The team identified PIWI's main interactors in the nucleus and the cytoplasm, which mediate the different functions of PIWI proteins in the two cellular compartments. The researchers also showed that these molecular interactions are highly conserved from sponges to humans, highlighting their crucial role in protecting the genome.

Making diagnostics simpler, cheaper, and open-source

Access to reliable molecular diagnostics in low- and middle-income countries is often limited by high costs and challenging logistics. Scientists from the Brennecke lab at IMBA and the Pauli lab at the IMP, together with collaborators in Ghana, presented a powerful alternative: a fully open-source, freeze-dried diagnostic assay based on RT-LAMP technology. This PCR-free kit is especially useful for quick, low-cost testing even away from laboratories.

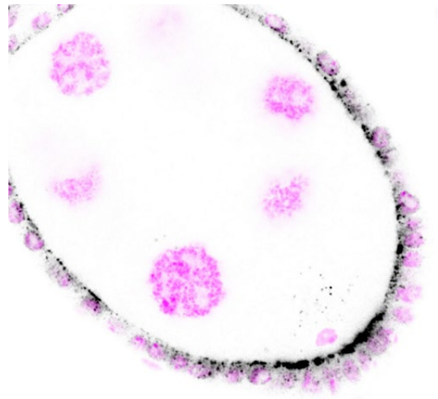
The assay's design focuses on expanding its uses to low-resource settings worldwide: its heat-stable and open-source reagents can be produced by diagnostics labs themselves, significantly reducing costs. In a proof-of-concept test, the freeze-dried RT-LAMP mixes were shipped to Ghana and delivered diagnostic performance on par with tests run in Vienna.



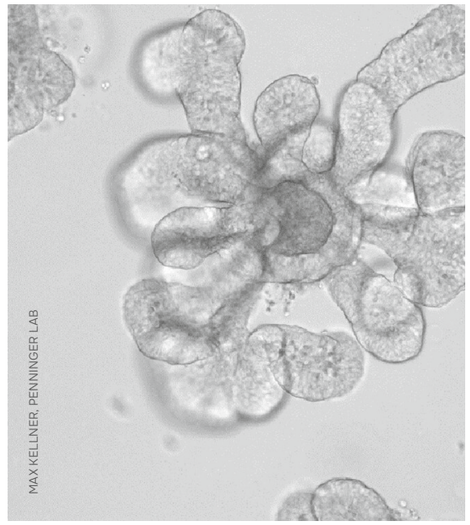
Adapt and innovate: How ancient viruses found their niche and fuel evolution

Once dismissed as genetic junk, ancient viruses embedded in our DNA are in fact powerful drivers of genome evolution. By developing new genetic sequences to better infect and reproduce within the host's cells, viruses also provide genetic building blocks for new genes and regulatory elements. But how do viruses evolve these diverse sequences in the first place?

A 2025 study by Julius Brennecke's lab offers a unique glimpse into how endogenous retroviruses diversified like Darwin's finches within the *Drosophila* ovary, each developing new regulatory sequences to adapt to a different cellular "niche." Their findings uncovered a remarkable example of the evolutionary arms race between host defenses and viral innovation, offering new insights into how evolution unfolds inside the genome.



KIRSTEN SENTI, BRENNECKE LAB



MAX KELLNER, PENNINGER LAB

Unlocking the secrets of bat immunity

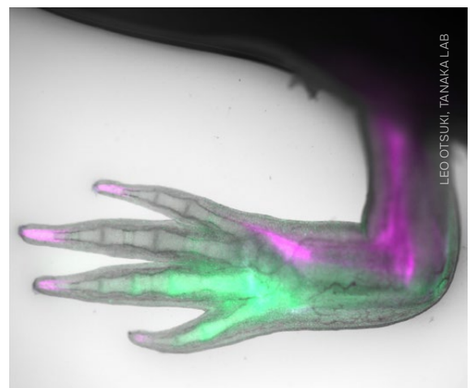
Bats act as natural hosts for many highly pathogenic viruses that can be deadly to humans but cause no sickness to the bats. An international research team including the Penninger lab developed a groundbreaking organoid platform to study the immune responses of bat mucosal tissues.

By generating organoids from the respiratory and intestinal tissues of Egyptian fruit bats—natural hosts of the Marburg virus—the scientists discovered that bat epithelial cells possess significantly stronger baseline antiviral defenses compared to human cells, enabling bats to suppress viral replication early and avoid disease. The study sheds new light on the unique resilience of bats and introduces an innovative model for future research into virus-host co-evolution and the development of antiviral therapies.

A positional code that allows axolotls to regrow limbs

With its fascinating ability to regrow entire limbs and internal organs, the axolotl is the ideal model to study regeneration. For healthy regeneration, regrowing body parts must "know" their position in the axolotl body so the right structure for a specific location can develop.

In 2025, scientists at the Tanaka lab identified the gene *Hand2* as the main factor that tells cells in the axolotl arm which region they are in, and what structures to regenerate after injury. Using this knowledge, the researchers were able to reprogram the identity of axolotl cells during regeneration, a significant step forward for tissue engineering and regenerative medicine that could potentially be applied to humans.



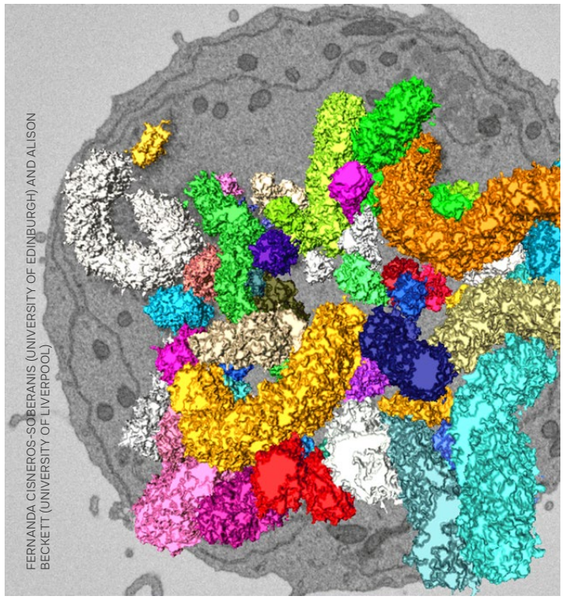
LEO OTSUKI, TANAKA LAB

In this video, Elly Tanaka explains the concept of positional information.

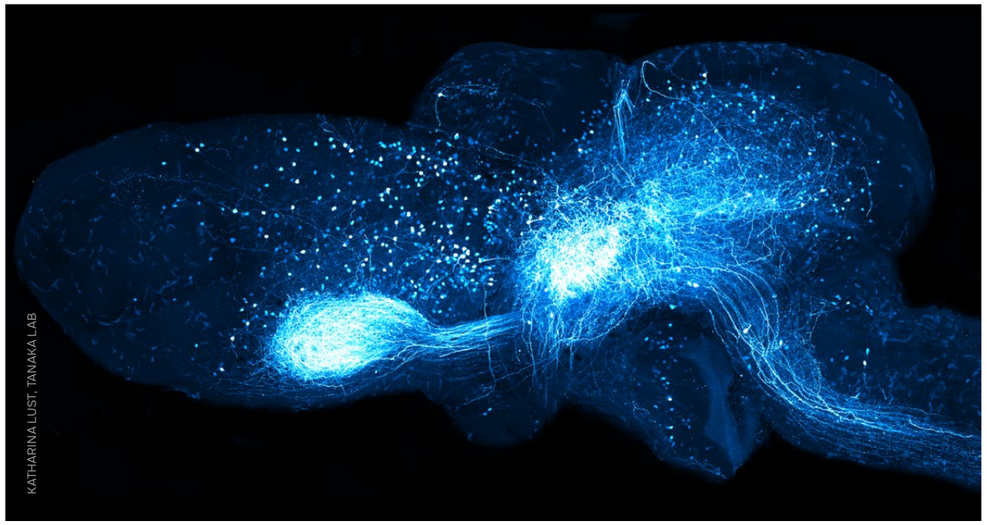
Rules of engagement: How DNA re-modelers shape mitotic chromosomes

During a cell's "daily life," a molecular motor called cohesin pulls individual DNA strands loose to facilitate gene expression and support cellular function. In the transition toward cell division, cohesin is replaced by another motor, condensin, which reshapes the DNA into tighter structures: mitotic chromosomes. This process ensures that long and tangled DNA strands are safely divided between daughter cells.

How cohesin and condensin interact when they meet one another along the DNA was poorly understood. An international consortium including Anton Goloborodko combined advanced micros-copy and genomic techniques with physics-based simulations to study the interactions between cohesin and condensin. The team defined a set of "rules of engagement" that govern the interplay between these two essential molecular motors and how they shape DNA structure.



FERNANDA CISNEROS-SOBERANIS (UNIVERSITY OF EDINBURGH) AND ALISON BECKETT (UNIVERSITY OF LIVERPOOL)



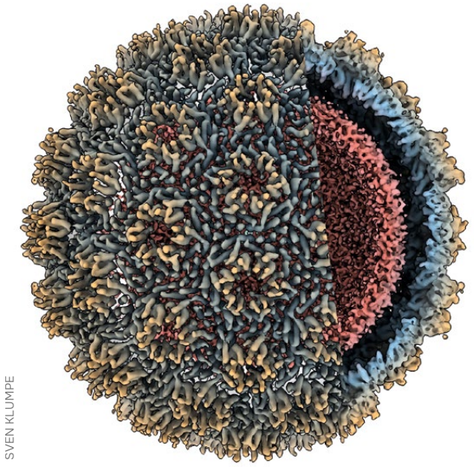
KATHARINA LUST, TANAKA LAB

Illuminating brain circuits in the axolotl

Studying the axolotl's nervous system is challenging due to the lack of tools for visualizing and manipulating neuronal circuits. Scientists from the Tanaka lab addressed this problem by developing a method for introducing genes into axolotl neurons, allowing scientists to interrogate neuronal organization in the axolotl.

The scientists employed adeno-associated viral vectors (AAVs) to introduce the marker GFP into the neurons of an axolotl. This approach allowed them to fluorescently label different neuronal types and visualize the projections connecting neurons across various brain regions, including between the brain and the retina. The study opened new ways for dynamically visualizing neurons in the axolotl brain and established viral vectors as powerful tools for introducing new genes into axolotl neurons and interrogating neuronal organization.

Watch the fluorescence scan of an axolotl brain revealing neuronal connections.



SVEN KLUMPE

Watch the in-cell 3D structure of the *copia* retrotransposon revealed.

First snapshot of a retrotransposon in action

In 2025, a retrotransposon was caught in action inside a cell at molecular resolution for the first time. By refining cryo-Electron Tomography (cryo-ET) techniques, an international study led by Sven Klumpe (then at the Max Planck Institute of Biochemistry) in collaboration with researchers in the Brennecke lab, imaged the retrotransposon *copia* in the egg chambers of the fruit fly *Drosophila melanogaster* to sub-nanometer resolution.

Employing recent advances in AI-based structure prediction, the team generated an integrative model of capsid assembly and showed that the *copia* retrotransposon adopts a capsid fold similar to the mature capsid of HIV-1. The team also provided snapshots of *copia*'s replication cycle within intact egg chambers. The study demonstrated the power of cryo-ET for studying the structural biology of transposons and provided detailed insights into the cellular mechanisms underlying their replication cycles.

Unprecedented protein quantification in single cells using advanced proteomics

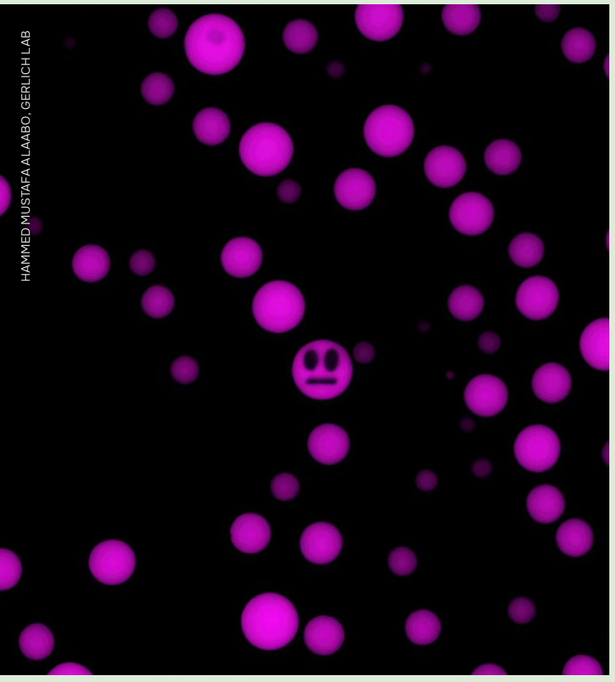
Single-cell proteomics enables the study of protein expression and function at the level of individual cells. By revealing details that are not detectable in bulk analysis, the field is transforming how scientists study proteins and their impact on cellular behavior.

Researchers at the Proteomics Tech Hub, in collaboration with Thermo Fisher Scientific and Nicolas Rivron's lab at IMBA, developed a new workflow that can quantify up to 5300 proteins in a single cell at unprecedented accuracy. In collaboration with Nicolas Rivron's team, the researchers performed single-cell proteomics on blastoids—stem cell-based models of the early human embryo—and were able to detect significant differences in protein expression among cells in the same lineage.

Behind the image

Three IMBA researchers opened the door mid-experiment and shared what they couldn't wait to show someone.

Annual reports tend to show the output of science: the finished or the published. So this year, we tried something different. We contacted IMBA's postdocs and PhD students asking for an image they were proud of, something that captured a key result or communicated their research. It didn't have to be perfect, just meaningful. Here's what came back.



MOHAMMED MUSTAFA ALAABO, GERLICH LAB

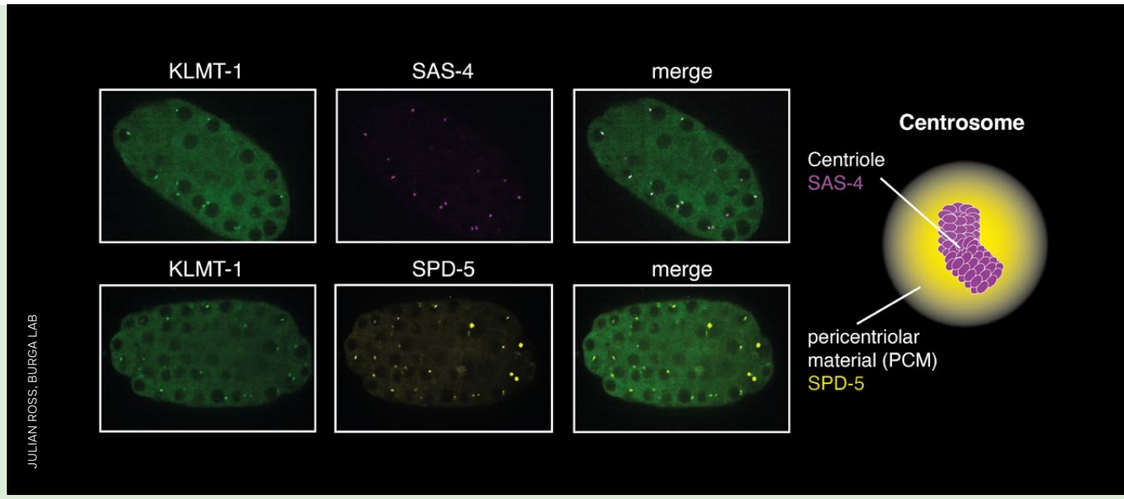
A smile that proves a point

Mohammed Mustafa Alaabo, a PhD student in the Gerlich lab, works with droplets of chromatin, the material that packages DNA inside the cell nucleus. These droplets behave like liquids: if you disturb them, they recover quickly. Researchers often test this by using a laser to bleach a spot within a droplet and watching it fill back in. Under low laser power, any mark disappears within two to three minutes. But Alaabo wanted to test what happens at high laser power, where the laser can cross-link the chromatin and lock its structure in place. So he drew a face on the droplets with the laser, and waited. "After 30 minutes, the face was still there," he says. "I thought it was cute."

The image is charming, but it also makes a serious point: some previous studies interpreted this kind of laser-induced stiffening as evidence that the droplets themselves behave like solids. Alaabo's image shows that the effect is an artifact of the method, not a property of the material.

Tracking a killer through the cell

Julian Ross, a PhD student in the Burga lab, studies a protein that is part of a selfish genetic element, or a piece of DNA that propagates itself at the expense of the host in the nematode worm *(Caenorhabditis tropicalis)*. The protein is destructive: unless it is reliably broken down, it kills the worm embryo. But how it does this was completely unknown. "We didn't have any idea of the mechanism," Ross says. "Then we tagged the protein and saw it localize to these distinct foci. That was the first hint." The protein had gathered into spots near the nucleus that looked very similar to the centrosome, a structure that plays a key role in cell division.



JULIAN ROSS, BURGA LAB

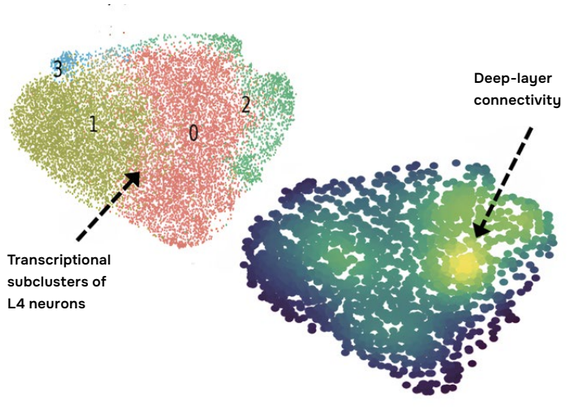
Were these spots truly centrosomes? To find out, Ross tagged known centrosomal proteins with differently colored fluorescent markers and looked again. The colored spots from both sets of proteins landed in exactly the same locations, confirming that the mystery protein does indeed localize to the centrosome. With that, the search for its mechanism of toxicity has a place to start.

The map that matched

Abel Vertesy, a postdoctoral researcher in the Knoblich lab, is trying to understand one of the most fundamental puzzles in neuroscience: how do neurons find each other? Among millions of cells, each neuron forms connections with a very specific set of partners, but the rules governing this process are still largely unknown. Vertesy's project is developing tools to map the connections of individual neurons, at high throughput, in brain organoids, miniature lab-grown models of the human brain. The goal is to study gene activity and physical connectivity in the same neurons at the same time.

The image he shared shows an early but striking result. When Vertesy plotted single neurons by their gene activity and clustered them by their molecular profiles, distinct subgroups appeared within what had previously been considered a single cell type. When he overlaid data about which neurons those cells connect to, the two maps aligned: these specific genetic subtypes were the ones connecting to deeper layers of the brain. "We were very excited to see these results," Vertesy says. "They open the door to understanding how and why human neurons connect to each other to form the connectome." It is a first glimpse of something that has never been directly shown before.

Connectivity to deep-layer neurons distinguishes subtypes of layer 4 excitatory neurons



ABEL VERTESY, KNOBLICH LAB

2–3 min

how long it takes for a mark on a chromatin droplet to disappear under low laser power

Research groups

In 2025, scientists at IMBA worked together in 12 research groups and one joint IMBA/IMP research group, often tackling scientific challenges in collaborations across single labs or institutes.

Curiosity, a passion for discovery, academic freedom, and a commitment to excellence: IMBA's research groups bring together scientists at all career levels, from students to principal investigators, and draw from a range of colleagues in support roles.

All principal investigators at IMBA lead independent research groups and programs. Young researchers receive support in starting their groups as junior group leaders focused on research; established faculty members also contribute to IMBA's leadership as senior scientists.

Transposon–host co-evolution | BRENNECKE LAB

Genomes are far more than static repositories of genetic information—they are dynamic ecosystems locked in an ongoing conflict with selfish genetic elements. Among these, transposons are the most pervasive invaders. By copying and inserting themselves throughout the genome, transposons disrupt gene function and threaten genome stability, yet they also serve as a powerful engine of evolutionary innovation. To cope with this threat, eukaryotes have evolved sophisticated defense systems that suppress transposons and enable long-term coexistence.

The Brennecke lab investigates the molecular logic of this evolutionary arms race, integrating mechanistic biochemistry with in vivo genetics. Its work reveals how small RNA-guided pathways silence transposons—and how transposons, in turn, adapt to evade repression—leading to unexpected insights into gene regulation, chromatin organization, and cell biology.

Current projects

The host side: The PIWI-piRNA pathway functions as a highly specialized, small RNA-guided "immune system" of the genome. It protects the germline by recognizing and silencing transposons and other foreign sequences. Over the past few years, the Brennecke lab has identified nearly 40 components of this pathway, providing a comprehensive framework for understanding genome surveillance. Using a multidisciplinary approach that spans genetics, biochemistry, structural biology, and cell and molecular biology, the team investigates how piRNAs are generated and how they induce chromatin compaction to silence transposons without perturbing normal gene expression programs.

The transposon side: To thrive within a host genome, transposons must continually innovate. In the *Drosophila* ovary, dozens of active transposon families have evolved diverse strategies to circumvent host defenses and exploit specific cellular niches. The Brennecke lab uses advanced *Drosophila* genetics to dissect how these elements adapt and spread. Combining phylogenetics, live and ultrastructural imaging—including cryo-electron tomography—and controlled experimental transposon invasions, the team aims to identify the general principles that underlie transposon adaptation. These studies not only illuminate the evolutionary dynamics of selfish genetic elements, but also provide a broader insight into retroviral evolution and host–pathogen interactions

LAB MEMBERS

Anja Adelmann, Melanie Bant, Andreas Bernhard, Roba Dawud, Dominik Handler, Svetlana Iarovenko, Ralf Jansen, Lea Katharina Lauterjung, Martin Matl, Julia Portell i De Montserrat, Liudmila Protsenko, Baptiste Rafanel, Kirsten Senti, Laszlo Tirian, Aleksandr Tsarev, Maya Shinan Voichek, Changwei Yu

Julius Brennecke | Group Leader

Julius Brennecke introduces his research into genetic conflicts and why the fruit fly *Drosophila melanogaster* is the ideal model for studying this arms race.

Genomic conflict | BURGA LAB

Natural selection typically favors genetic variants that improve an organism's ability to survive and reproduce. However, genomes also harbor sequences that follow a very different evolutionary logic. A significant proportion consists of selfish genetic elements, DNA elements that boost their own transmission, even when this offers no advantage to the organism or, in the most extreme of cases, harms the organism in the process.

Once seen as "genetic outlaws" to be tolerated or suppressed, selfish genes are now recognized as powerful drivers of genetic innovation. Their evolutionary tug-of-war with the host fuels biological innovation and complexity. The Burga lab uses nematodes as a model to study how these genetic conflicts shape evolution, focusing on toxin-antidote (TA) elements—a newly discovered class of selfish gene that ensures its inheritance by killing those embryos that do not carry a copy. Understanding how toxin-antidote elements emerge from normal genes and spread within populations could inform future gene drive systems to, for example, control disease-carrying mosquito populations.

Current projects

The evolution of toxin-antidote selfish elements: Toxin-antidote elements consist of two linked genes encoding for a toxin and its antidote. Despite not providing an evolutionary advantage, TA elements have independently evolved in fungi, insects, nematodes, and plants. The Burga lab combines genetic, computational, and structural biology approaches to study how TAs arise, how the toxin-antidote pairs interact at the molecular level, and how toxins manipulate embryonic development to skew inheritance in their favor.

Mavericks as vectors of horizontal gene transfer: Genes are often transmitted from parents to offspring, but can also jump between organisms from different species—a process known as horizontal gene transfer. The Burga lab recently discovered that Mavericks, a type of virus-like transposon, mediate horizontal gene transfer between different nematode species. The team now aims to replicate the Maverick life cycle in the lab to study how Mavericks gained this ability and dissect the mechanisms enabling gene transfer across animal species.

LAB MEMBERS

Kolin Angelo Echano, Keroshini Guynes, Andreas Hagmüller, Anja Koller, Alevtina Koreshova, Daniel Ciro Krogull, Tianhua Liao, Hana Marvanova, Francis Belen Pacheco Fiallos, Pinelopi Pliota, Florian Pühringer, James Julian Ross, Polina Tikanova, Sonya Angeline Widen, Sara Wighard

Alejandro Burga | Group Leader

Discover how the Burga lab investigates the molecular determinants of biological idiosyncrasy.

Chromosome structure and dynamics | GERLICH LAB

Genetic information is stored in long DNA molecules that, if unraveled, would reach up to two meters in humans. These long molecules must be tightly organized within the small space of a cell's nucleus to ensure that genetic information is efficiently read, replicated, and transmitted during cell division. Additionally, the three-dimensional structure of the genome must adapt to different needs, such as development, DNA damage response, and cell proliferation.

The Gerlich lab combines cell biology with in vitro biochemistry and biophysics to study how genomes are organized in three-dimensional space and how this organization affects cellular processes such as DNA replication, cell division, and cell death. In recent years, the team, comprised of biologists and computer scientists, developed new methods for mapping chromosome structure and interactions with unprecedented resolution.

Current projects

Organization of mitotic chromosomes through cell division: During cell division, chromosomes must be replicated and tightly packaged to ensure that they are properly divided up between the daughter cells. The Gerlich lab studies these processes using a combination of biophysics and biochemistry approaches to learn how chromosome shape is maintained during replication and how chromosomes are packaged before division.

Homology search during DNA repair: To accurately repair DNA breaks, the cell's repair mechanisms form a DNA repair filament that can comb billions of nucleotides in the genome with surprising speed and find a matching template. The Gerlich lab combines cell imaging and biochemistry assays to study the molecular mechanisms that help DNA repair filaments travel within the nucleus to find their match so effectively.

Chromatin compaction during cell death: During programmed cell death, the cell's DNA is compacted to ensure that the cellular remains can be cleared without triggering inflammation. The Gerlich lab studies the molecular mechanisms that package chromatin during this process.

LAB MEMBERS

Mohammed Mustafa Alaabo, Caelan Bell, Claudia Blaukopf, Joseph Neos Cruz, Theresa Dangl, Shelley Nadhi Fernando, Takuya Hidaka, Christoph Langer, Dmitry Mylarshchikov, Ines Prlesi, Vincent Patrick Reuter, Nikki Schütte, Maximilian Frederick Spicer, Thomas Steinacker, Zsuzsanna Takacs, Federico Teloni

Daniel Gerlich | Group Leader

Daniel Gerlich discusses his group's research on genome organization in the cell's three-dimensional environment.

Theoretical models of chromosome structure | GOLOBORODKO LAB

Chromosomes pack a vast amount of genetic information into a tiny space. To keep cells running smoothly, a network of molecular machines constantly reshapes chromosome architecture, ensuring that the right DNA regions are accessible for essential tasks such as transcription, replication, and repair.

The Goloborodko lab blends methods from theoretical statistical physics, computer simulation, and computational biology to study how molecular motors establish the genome's three-dimensional structure, how this genomic structure changes to adapt to cellular needs, and how it influences genome function and cell division. Its goal is to reveal the hidden molecular rules governing the genome's dynamic architecture.

Current projects

Homology search in DNA repair: DNA damage threatens genome integrity and cell survival. In order to quickly and accurately repair DNA breaks, cells perform a "homology search" to find a matching DNA sequence in the genome to use as a repair template. The Goloborodko lab uses physics-based simulations to explore how the cell's repair machinery scans the genome, locates the homologous region, and brings it close to the damaged site to enable precise repair.

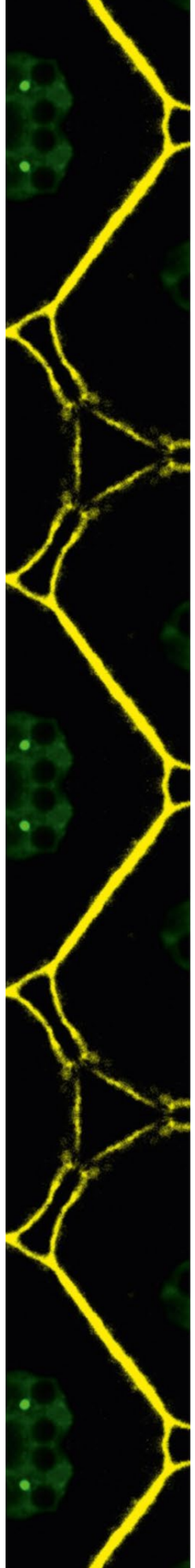
Chromosome organization and packaging during mitosis: Before a cell divides, its DNA must be tightly compacted to ensure the correct segregation into daughter cells. The Goloborodko lab examines how cohesin and condensin—molecular machines that rearrange DNA—interact to fold and stabilize the DNA into packed chromosomes during this critical stage. Its work sheds light on the molecular mechanisms and physical principles that maintain structural order to ensure successful cell division.

Open2C: a community for the development of open-source data analysis tools: Modern genomics generates enormous amounts of data that require powerful tools for processing, analysis, and visualization. The Goloborodko lab is a key part of the Open Chromosome Collective (Open2C), an international community of bioinformaticians that collaboratively develops open-source software for 3D genome biology. These tools make cutting-edge data analysis accessible to researchers worldwide.

LAB MEMBERS
Sonja Berger, Stefano Cretti, Vladimir Dmitriev, Ankit Gupta, Maximilian Kaltenegger, Daniel Paul, Emma Rusch, Hadiya Shamim, Olesia Slavska, Leona-Valentina Vracar

Anton Goloborodko | Group Leader

Discover how the Goloborodko lab investigates the theoretical models of chromosome structure.



Mechanisms of brain plasticity and repair | GRADE LAB

Acute injuries such as strokes and progressive conditions such as neurodegenerative diseases damage specific brain regions, leading to loss of motor control and other essential functions. These conditions are major causes of disability and mortality worldwide. Although the adult brain has a very limited regenerative capacity, it can adapt to injury to some extent by rewiring its circuits, forming new connections that help preserve or substitute brain function.

The Grade lab studies how brain circuits rewire following injury in mouse models and explores the potential of stem cell transplantation to promote regeneration and restore brain function following injury or disease.

Current projects

Reorganization of neuronal circuits in neurological disorders: Acute injuries to the brain cause neuronal loss and neuroinflammation. In response, neural stem cell niches produce new neurons that integrate into existing networks, rewiring the brain, and even modifying behavior in animal models. The Grade lab combines advanced whole-brain imaging, circuit tracing, and molecular biology techniques to investigate how the brain reorganizes its neural circuits in response to pathological events, aiming to uncover the mechanisms that drive brain repair and adaptation.

Restoration of brain circuits using stem cells: Stem cell transplantation offers a promising approach for treating tissue damage, providing new cells to help reconstruct damaged tissues. In collaboration with the Knoblich lab, the Grade lab investigates whether organoid-derived neuronal progenitors transplanted into the injured cerebral cortex can provide new neurons and promote brain regeneration. Their work examines how transplanted stem cells can differentiate into different types of functional neurons and whether they integrate into existing neural circuits to restore lost brain functions.

LAB MEMBERS
Martina Beccari, Oisorjo Chakraborty, Niccolo De Marzo, Maria Nazareth Gonzalez Alvarado, Samuele Maturi, Tereza Oppelt Duranova, Petra Schaffer, Sofia Cristina Soares De Morais Grade Lehmann, Sabrina Villar Pazos

Sofia Grade | Group Leader

Discover how the Grade lab investigates plasticity and repair after brain injury.

Dark genome in early mammalian development | JACHOWICZ LAB

After fertilization, newly formed embryonic cells must tune embryo-specific genetic programs that will define their future identity. To do so, cells rearrange their genome in 3D nuclear space and start new gene expression programs. How this early genome organization and transcriptional programs are established remains largely unknown, however.

The Jachowicz lab investigates how "dark" genome elements, specifically transposable elements (TEs) that constitute approximately 50 percent of the mammalian genome, drive these changes. The team applies cutting-edge tools—including microscopy, multiomics sequencing methods, and RNA-centric biochemistry approaches—in mouse embryo models and embryonic stem cells, aiming to uncover the hidden regulatory roles of transposable elements in shaping the earliest stages of development.

Current projects

Mechanisms of post-fertilization chromatin compartmentalization: After fertilization, the sperm and oocyte genomes merge and rapidly reorganize in 3D to form the embryonic genome. While this early restructuring sets the stage for gene activation and development, its underlying mechanism is unclear. The Jachowicz lab combines CRISPR-based gene perturbation, advanced microscopy, and split-pool barcoding (SPRITE) to dissect the molecular and biophysical mechanisms that facilitate genome organization in the earliest stages of development.

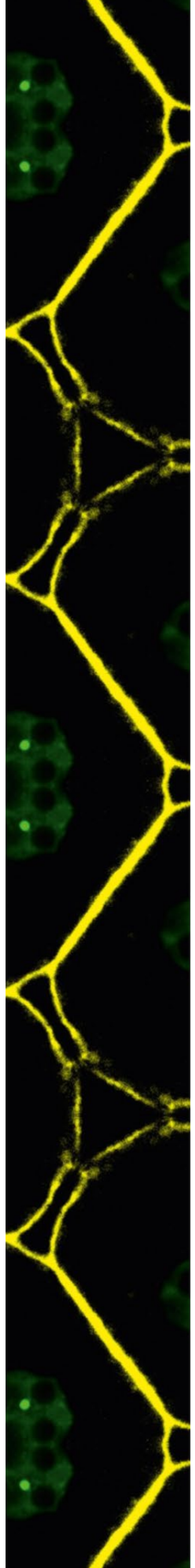
The role of transposable elements in preimplantation development: Transposable elements make up more than half of the mammalian genome. Once considered parasitic or non-functional, growing evidence suggests that these elements play active and essential roles in regulating genome architecture and gene expression during early embryonic development. The Jachowicz lab aims to uncover how transposon-derived RNA and proteins interact with chromatin to regulate gene expression and genome structure during the preimplantation stages of mouse development. Through genome-wide perturbation screens, as well as high-resolution chromatin and transcriptomic profiling, the team seeks to reveal how these ancient genomic elements help orchestrate the earliest steps of life.

LAB MEMBERS

Elias Balestrini, Michal Tomasz Ciarka, Antonio Docavo Garcia, Agnieszka Gacek-Matthews, Julia Kernler, Danica Milovanovic, Pietro Peron, Siegfried Schloißnig, Agastya Singh, Aranxa Torres Caballero, Ziga Vicic, Georgios Vlachos

Joanna Jachowicz | Group Leader

Joanna Jachowicz introduces her research into the role of the dark genome in early development and how these elements shape our human trajectory.



In situ structural biology laboratory | KLUMPE LAB

Transposable elements, or "jumping genes," are mobile genetic parasites capable of copying and inserting themselves throughout the genome. While their activity poses a major threat to genome stability, the molecular mechanisms and cell biological processes that enable transposon activity often remain elusive.

To address this gap, the Klumpe lab uses cryo-electron tomography (cryo-ET)—a cutting-edge imaging technique for generating three-dimensional reconstructions of rapidly frozen biological samples with an electron beam at molecular resolution. Structural information gained by cryo-ET is then used to reconstruct three-dimensional models that provide key insights into how structure influences biological function. By combining cryo-electron tomography with biochemistry and genetic tools in the fruit fly *Drosophila melanogaster*, the team seeks to reveal the cell biology of transposon activity in the germline.

Current projects

Structural biology of the *D. melanogaster* LTRome: LTR retrotransposons (LTRs)—a class of transposable elements closely related to retroviruses—represent an important threat to genome stability. In *Drosophila* germline cells, these elements are normally silenced, but when reactivated, they offer a unique opportunity to study transposon biology in action. The Klumpe lab uses cryo-ET to visualize active LTRs within germline cells, uncovering how they move, replicate, and interact with host defenses—insights that may inform understanding of similar elements in genomes across the tree of life, including us humans.

Technology development for cryo-FIB milling and in situ cryo-ET: High-quality sample preparation is essential to guarantee successful cryo-electron tomography. To prepare samples for cryo-ET, scientists use a "cell slicing" method called cryo-focused ion beam milling (cryo-FIB). Sven Klumpe has developed innovative methods to improve sample quality when using cryo-FIB, increasing the throughput and success rate of cryo-ET and expanding the spectrum of samples amenable to in situ cryo-ET. His team continues to develop new methodological improvements for sample preparation, aiming to make cryo-ET more accessible to other scientists and to facilitate biological discoveries.

LAB MEMBERS

Artem Kushner

Sven Klumpe | IMP IMBA Fellow

Discover how the Klumpe lab develops and applies technologies for in situ structural biology to address questions in germline biology with a special interest in transposable elements.

Brain development and disease | KNOBLICH LAB

The human brain is the most powerful and complex organ found in nature, composed of billions of interconnected neurons. The Knoblich lab seeks to understand how this intricate network develops—and how errors in its formation can lead to neurological disorders.

To achieve this, the team pioneered 3D tissue models known as cerebral organoids, which are grown from human stem cells and replicate key stages of brain development. By comparing organoids derived from healthy individuals and patients, the researchers study the genetic and molecular causes of neurodevelopmental disorders such as epilepsy and autism.

Current projects

Genetic screening in cerebral organoids: To study the genetic causes of autism spectrum disorders, the Knoblich lab developed CRISPR-LICHT and CHOOSE, two CRISPR-based tools that enable gene function screening at the single-cell level in cerebral organoids. Using these approaches, the researchers can measure how individual genes influence key developmental processes such as neuron proliferation and migration. They can thereby identify vulnerable cell types and gene regulatory networks that could contribute to autism spectrum disorders.

Modeling defects in neural network activity in epilepsy: Cerebral organoids can mimic the cellular and structural abnormalities that cause neurological diseases such as epilepsy. Using patient-derived cerebral organoids, the Knoblich lab identified the specific cell type whose abnormal proliferation triggers Tuberous Sclerosis Complex (TSC), a severe neurological disorder that leads to childhood epilepsy. The team is now studying how the structural changes caused by TSC affect electrical signaling in the brain to produce epileptic activity.

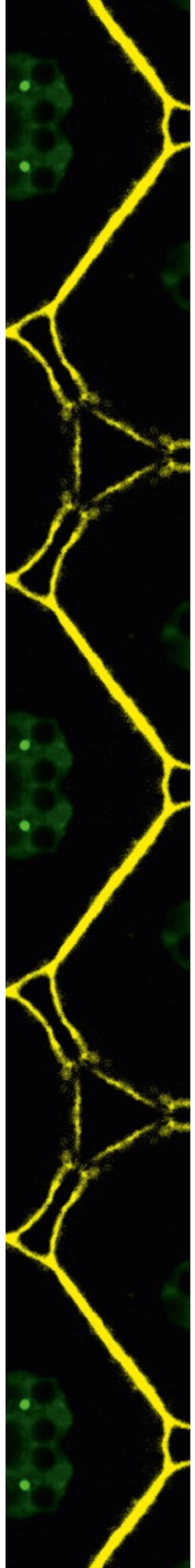
The role of human-specific postnatal neurogenesis: Even after birth, the human brain continues to produce large amounts of new neurons called interneurons, which migrate to the cerebral cortex and integrate into existing neuronal circuits, adding to the human brain's complexity. The Knoblich lab uses cerebral organoid models to dissect the molecular mechanisms regulating interneuron generation and migration in the developing brain, and to determine how disruptions in this process contribute to neurodevelopmental disorders.

LAB MEMBERS

Emilia Asgrimsdottir, Eva Binder, Nina Stefanie Corsini, Balint Doleschall, Oliver Ludwig Eichmüller, Shamsi Emtenani, Peter-Christopher Esk, Oguzhan Kaya, Olena Kim, Hyosang Kim, Jürgen Knoblich, Laura Kracht, Christian Krauditsch, Christian Lehmann, Viktoria Leitner, Jamie Blaze Littleboy, Sakurako Nagumo Wong, Ramsey Najm, Mark Alan Noble, Ema Novakova, Jelena Obradovic, Anna Pianezzola, Sushant Priyam, Sandra Schepers, Ana Stravs, Jan Themann, Hanne Twenhöfel, Abel Vertesy, Michael Alexander Zabolocki

Jürgen Knoblich | Group Leader

Discover how the Knoblich lab investigates brain development and disease.



Deciphering heart development and disease | MENDJAN LAB

The heart is the first functional organ to form in an embryo. Heart development is a complex, multi-step process shaped by both genetic programs and mechanical forces. Disruptions at any step can lead to serious heart defects.

To study heart development in detail, the Mendjan lab developed the first lab-grown heart chamber-like models, known as cardioids. These organoids mimic the development and function of the embryonic heart. Using this breakthrough model, the team investigates the molecular mechanisms that drive heart formation, and how errors in these processes lead to heart disease.

Current projects

Heart growth and regeneration: The adult heart has little capacity to regenerate after injury such as heart attack, forming scar tissue instead of new cardiac muscle. In contrast, the growing fetal heart can repair itself. To better understand fetal regeneration, the Mendjan lab is advancing cardioid models to include immune cells, fibroblasts, and other key components to recreate cardiac repair in the lab for the first time. Using this model, the team will investigate the molecular mechanisms guiding regeneration and inform new potential therapies to enhance recovery after heart attack.

Cardioid vascularization and circulation: The heart's nonstop activity requires a constant nutrient supply from coronary circulation. However, how the heart's blood vessels form during embryonic development and how they sustain the heart's growth is still unclear. The Mendjan lab is advancing their cardioid models to induce blood vessels to form, an important step toward a comprehensive view of the heart's development and how circulation sustains it.

Balancing mechanobiology and pacing with growth in cardioids: The human heart begins to form during the first days of development and starts beating as early as day 23. From that moment on, it faces a remarkable challenge: continuously pumping blood while billions of new cardiomyocytes are produced and seamlessly integrated into the contracting heart muscle. By investigating how heart function and growth are coordinated, the Mendjan lab aims to reveal the mechanisms that allow the fetal heart to expand and strengthen without interrupting its essential, life-sustaining beat.

LAB MEMBERS

Kamil Belyalov, Lavinia Ceci Ginistrelli, Anna Dimitriadi, Tobias Ilmer, Stefan Jahnel, Estela Mancheno Juncosa, Maximilian Mayrhauser, Amra Mujadzic, Henrieta Papuchova, Doris Pfarr, Lena Plank, Lena Maria Stumbauer, Katarzyna Warczok

Sasha Mendjan | Group Leader

Discover how the Mendjan lab investigates human cardiogenesis and disease.

Blastoid development and implantation | RIVRON LAB

Despite our species' success, human fecundity is relatively low and pregnancy often fails. Only about one third of human conceptions result in live births, and roughly 30 percent of pregnancies are lost during the first trimester—a number significantly higher than in chimpanzees, our closest living relatives.

To understand the mechanisms responsible for the specific traits of human reproduction and their impact on our species, the Rivron lab retraces the evolutionary and developmental history of early pregnancy. Its research focuses on placentation and implantation, when the vital yet conflictual connection between embryonic and maternal tissues is formed. In contrast to most mammals, great ape embryos—including humans—embed deeply within the endometrium, using this intimate connection to the maternal tissue and richer blood supply to develop a larger fetus with energy-demanding structures such as a more developed brain.

The team aims to uncover which genetic, molecular, and cellular innovations emerged in human embryos and uteri and how these adaptations generated both the advantages and vulnerabilities of human pregnancy. For this, the team uses stem cell-derived models of the blastocyst (blastoids) and endometrium (organoids), which enable the mechanistic and high-throughput study of human pregnancy in vitro for the first time.

Current projects

Identifying human-specific genetic elements regulating blastocyst development and implantation: Human blastoids are a unique model to systematically investigate how gene regulatory networks and cellular programs evolved in human embryos as compared to other primates. The Rivron lab studies how evolved genetic elements regulate transcription factors and cellular programs essential for trophectoderm attachment and invasion into the endometrium, thereby initiating implantation.

Identifying the principles of human blastocyst self-organization: To form the different structures of the embryo, cells must communicate, self-organize, and acquire specialized functions, such as maintaining the stem cell pool or forming the primitive syncytium, a multinucleated tissue critical for implantation into the maternal endometrium. Through comparative analyses of blastocyst tissues and cell morphologies across species, the Rivron lab seeks to define how molecular and mechanical signals during early development are integrated and how they influence the pacing of multicellular self-organization.

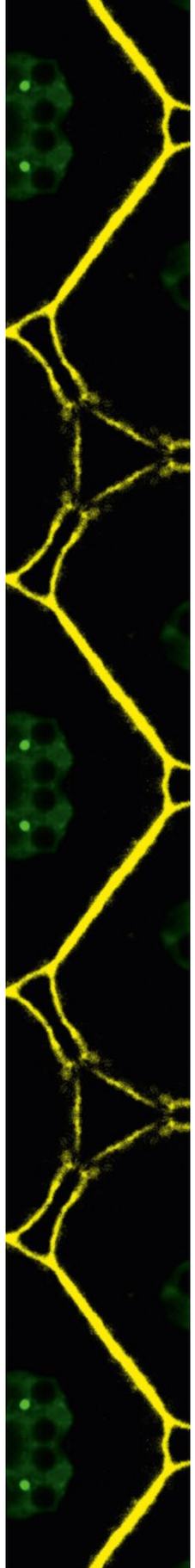
This research could shed light on the evolutionarily inherited adaptive advantages and intrinsic vulnerabilities of human pregnancy and their consequences for our species.

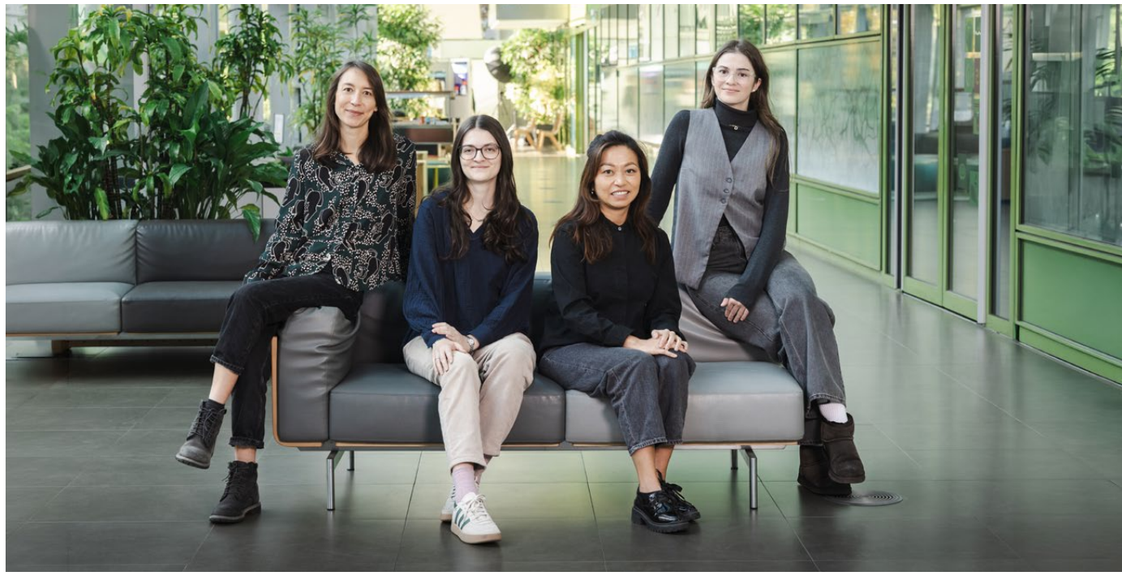
LAB MEMBERS

Franziska Fazekas, Alexandr Gureenkov, Heidar Heidari Khoei, Christos Kyprianou, Iris Markja,Marlene Müller, Anna Osnato, Saurabh Jagdish Pradhan, Ronan Quenec'hdu, Nicolas Rivron, Yvonne Suzanne Scholte Op Reimer, Jinwoo Seong, Giovanni Sestini, Jana Slovakova, Theresa Maria Sommer, Emiel van Genderen, Myrto Vrentzou

Nicolas Rivron | Group Leader

Nicolas Rivron discusses his research into stem cell-based embryo models for studying early stages of pregnancy.





Environmental and metabolic regulators of embryonic development | STAPORNWONGKUL LAB

Embryonic development is an extraordinarily energy-demanding process. Cellular metabolism converts nutrients into energy and building blocks to support the embryo's growth. In addition, metabolic processes can affect cell fate decisions shaping the embryo. Kristina Stapornwongkul recently discovered that sugar metabolism regulates developmental signaling pathways in embryonic stem cells, thereby controlling the emergence of the three germ layers, the precursor cells that give rise to all tissues of the embryo.

Building on these findings, the Stapornwongkul lab investigates how metabolism regulates early human development. Using stem cell-based embryo models, the team studies how a cell's metabolic state—the nutrients it senses and the pathways it activates—guides fate decisions and morphogenesis at the molecular level.

Current projects

How metabolism influences cell fate decisions: Metabolic enzymes and metabolites do more than generate energy—they can also act as regulators of developmental signaling pathways. The Stapornwongkul lab wants to understand the underlying molecular mechanisms that link metabolic processes to the fate decisions that determine early embryonic cell identities.

The energetics of morphogenesis: Building an embryo requires tremendous amounts of energy for cells to grow, divide, migrate, and reorganize into complex structures. The Stapornwongkul lab aims to measure the energy demands of these processes and study how developing cells adjust their metabolism to overcome energetic constraints.

The impact of the nutritional environment on development: Embryos rely on their environment to obtain all the necessary nutrients to survive and grow. The Stapornwongkul lab examines how changes in nutrient availability affect key developmental processes such as patterning, cell differentiation, and tissue morphogenesis.

LAB MEMBERS

Ho Yee Chan, Tamara Civetta, Tatiana Firfa

Kristina Stapornwongkul | Group Leader

Discover how the Stapornwongkul lab investigates environmental and metabolic regulators of embryonic development.

Molecular mechanisms of vertebrate regeneration | TANAKA LAB

The axolotl *(Ambystoma mexicanum)*, a Mexican salamander species, has a remarkable ability to regenerate: it can regrow lost limbs, its tail, and even parts of its heart and brain. To achieve this extraordinary feat, regenerating cells must know precisely where they are in the body and which structures they should rebuild.

The Tanaka lab studies the molecular mechanisms underlying the axolotl's regenerative capacities, seeking to discover the fundamental principles of regeneration that could inform regenerative medicine in the future.

Current projects

Stem cell formation and differentiation after injury: In humans, fibroblasts respond to injury by proliferating and producing scar tissue. In the axolotl, these same cells respond differently, de-differentiating into stem cells capable of forming a range of new tissues. The Tanaka lab studies how axolotl fibroblasts re-enter a stem cell state and drive complete regeneration after injury.

How positional memory guides regeneration: To correctly rebuild complex structures such as limbs or a tail, the axolotl's fibroblasts rely on very precise positional information that tells them where they are located and which structures to form. The Tanaka lab studies the molecular "zip codes" that encode this spatial memory and the gene networks that maintain it during regeneration.

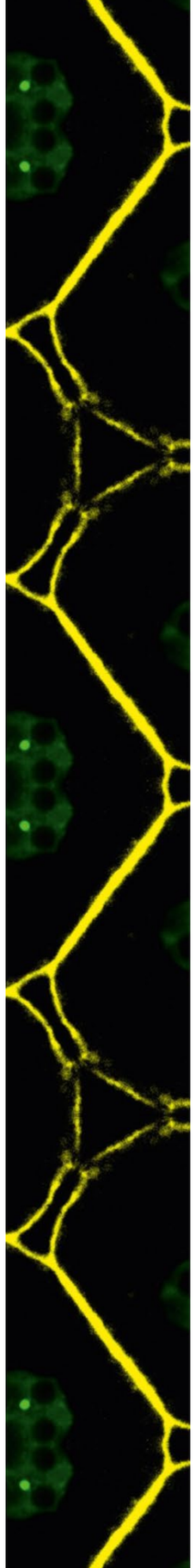
Nervous system regeneration: from stem cells to circuits: Regenerating the nervous system is especially challenging because new neurons must integrate into existing circuits and reconnect accurately to restore function. The Tanaka lab explores how neurons in an axolotl's regenerating limb reconnect to muscles and skin to restore movement and sensation. The team also investigates how the axolotl can regenerate part of its visual system and reconnect its retina and brain to restore vision. The team's findings could inform new neural regeneration strategies in mammals.

LAB MEMBERS

Martin Nuamah Asare, Onur Bayram, Fernando Becerril Perez, Miray Naz Bozkurt Ay, Alberto Carlino, Elena Costantini, Deniz Leonard Demirkesenler, Francisco Falcon Chavez, Andre Fischer, Lucrezia Galli, Salvador Gonzalez Juarez, Simone Horenkamp, Teresa Krammer, Katharina Judith Lust, Wouter Masselink, Helena Okulski, Leo Otsuki, Viktoria Paller, Anja Pelzl, Anastasia Polikarpova, Stephan Alexander Raiders, Diego Rodriguez Terrones, Paulina Schwaiger, Cecilia Schwarzer, Carina Seidl, Hannah Taylor Stuart, Yuka Sugiura, Takuji Sugiura, Pietro Tardivo, Jingkui Wang, Jiaye Yang, Julian Jakob Zimmermann

Elly Tanaka | Scientific Director

Elly Tanaka discusses her research into regeneration and highlights how work on the axolotl is creating insights also for human regeneration.



Regulation of neural stem cell quiescence | URBÁN LAB

Stem cells play a crucial role in maintaining homeostasis and enabling repair in adult tissues. Throughout life, specialized neural stem cell niches in the brain generate new neurons that integrate into existing neuronal circuits, supporting essential functions such as olfaction and memory. These stem cells can stay "frozen" for years in a paused state known as quiescence, which preserves their potential and prevents premature brain aging.

The Urbán lab investigates how internal and external cues regulate the delicate balance between neural stem cell quiescence and activation throughout life. Using mouse models, the researchers explore how adult neural stem cells decide when to produce more neurons and how environmental factors shape this decision. Their goal is to understand how normal processes such as aging affect the brain's ability to produce new neurons.

Current projects

Neural stem cell heterogeneity: Neural stem cells are often described as either quiescent or actively producing new neurons. Reality appears to be more nuanced, however. The Urbán lab uses advanced transcriptomics to map the diverse transcriptional states of adult neural stem cells and study how they affect their activity. With this information, the researchers hope to establish a new, dynamic model to explain how neural stem cells behave and transition between states in the adult brain.

Studying the role of proteostasis in adult neural stem cell quiescence: When adult neural stem cells transition from a quiescent to an active state, they must undergo profound interior remodeling, including the elimination of quiescence-associated proteins. The Urbán lab studies how this shift in protein synthesis and degradation—proteostasis—is regulated, uncovering the molecular mechanisms that enable stem cells to reawaken and generate new neurons.

LAB MEMBERS

Alejandro Alarcon del Carmen, Juliane Christina Baar, Xabier Blanco Fernandez, Elvira Maria Carbonell Martinez, Bernardo Chombo Alvarez, Tatjana Kepcija, Justus Kleifeld, Lidija Milojkovic, Ninetta Molnar, Greeshma Pushpa Bose, Giulia Scaravillo, Katherina Tavernini, Noelia Urban Avellaneda, Ana Paula Zen Petisco Fiore

Noelia Urbán | Group Leader

Noelia Urbán introduces her research into the regulation of quiescence in neural stem cells.

Modeling human disease | PENNINGER LAB

The Penninger guest group at IMBA seeks to understand the mechanisms underlying human diseases, aiming to identify novel therapeutic strategies. The lab develops and deploys a broad range of in vitro and in vivo tools, including genetic editing, (glyco)proteomics, haploid cells for genetic and compound screening paradigms, animal and human organoid cultures, as well as genetically engineered mice. These multidisciplinary techniques allow the Penninger lab to model and study the complexity of human diseases, with a particular focus on the immune system, brain, heart, gastrointestinal tract, and cardiovascular system, as well as cancer.

Current projects

Next generation tissue engineering: The Penninger guest group leverages human stem cell-derived vascular and hematopoietic organoids to model blood and vascular diseases and to advance the next generation of human tissue engineering. They have developed novel microfluidic devices that introduce physiological flow into vascular organoids in vitro and are using bone marrow organoids to study hematopoiesis, the formation of cellular components of blood. Moreover, the Penninger lab has pioneered the generation of bat organoid models to study host-virus interactions in natural reservoir species and to uncover the molecular and evolutionary determinants of human viral diseases.

Intestine remodeling during pregnancy and lactation: During pregnancy, the female body undergoes profound physiological changes that prepare its various organs to ensure the health of both mother and child. The Penninger lab investigates these adaptations and the molecular mechanisms that drive them. In 2024, the team described the molecular mechanism that causes intestinal villi to enlarge significantly during pregnancy, increasing nutrient absorption to ensure proper nourishment of the fetus and newborn.

LAB MEMBERS

Emanuel Isaias Tenorio Araujo, Shane Cronin, Paula Erfurt, Androniki Menelaou Gaitanis, David Glinsner, Astrid Hagelkrüys, Rubina Koglgruber, Simon Licht-Mayer, Hannah Mayr, Stefan Mereiter, Tiago Manuel Fontes Oliveira, Masahiro Onji, Josef Penninger, Leonhard Spona

Josef Penninger | Group Leader

Discover how the Penninger lab is modeling human disease.

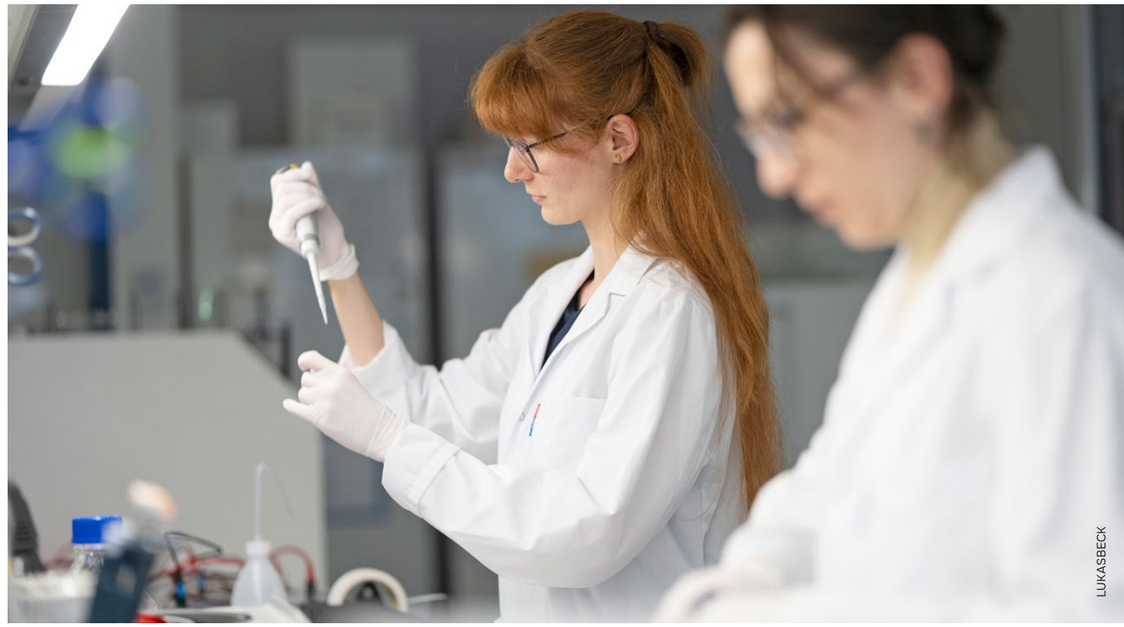
Our services

Collective support and shared expertise from scientific facilities, administration, and other services make an essential contribution to research at IMBA.

Behind every figure and result lie multiple stories. They unfold in shared offices, prep rooms, procurement emails, safety briefings, budget spreadsheets, and late-night troubleshooting sessions. These stories are the product of imaging suites and histology rooms, of sequencing platforms and animal facilities, of media kitchens and tissue culture rooms. It is people working in services such as administration, infrastructure, and Core Facilities who, together with scientists in research groups, translate scientific intent into something that can be built, measured, analyzed, and sustained over time.

This is the terrain where ideas meet innovation and where people working in support services tackle an essential question: what will it take to make this idea succeed? Each lab is flanked by an ecosystem of experts who translate ambition into protocols, timelines, and functioning infrastructure.

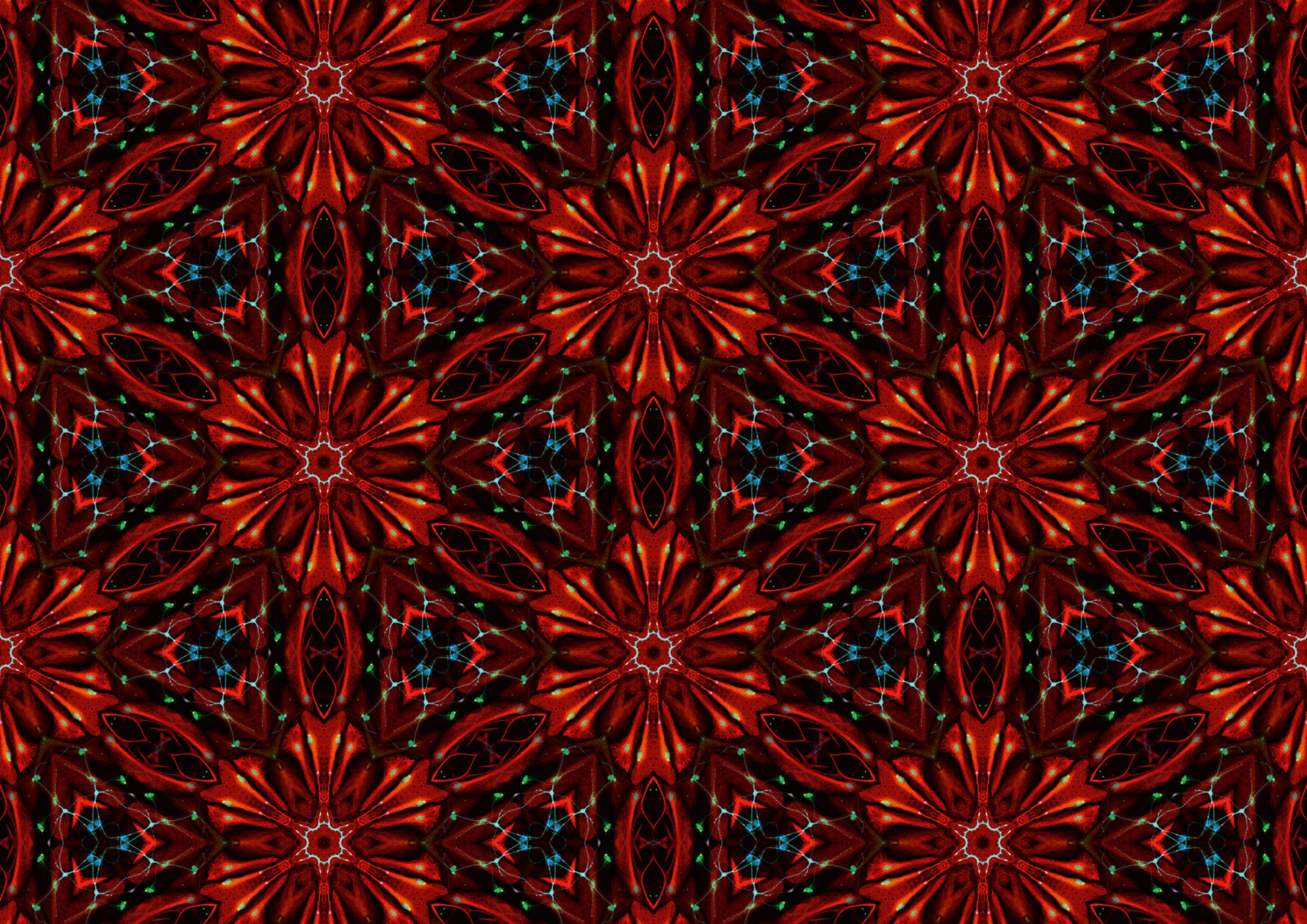
In Confessions of Core Facilities, we go backstage to hear from the people who operate in that in-between space and who have a few things they wish scientists knew. Read the story in the third volume, “Fabric of Discovery.”



LUKASBECK

Protein Technologies is part of the support ecosystem behind research at IMBA. Seen here is Lenka Barton and Audrey Crousilles.

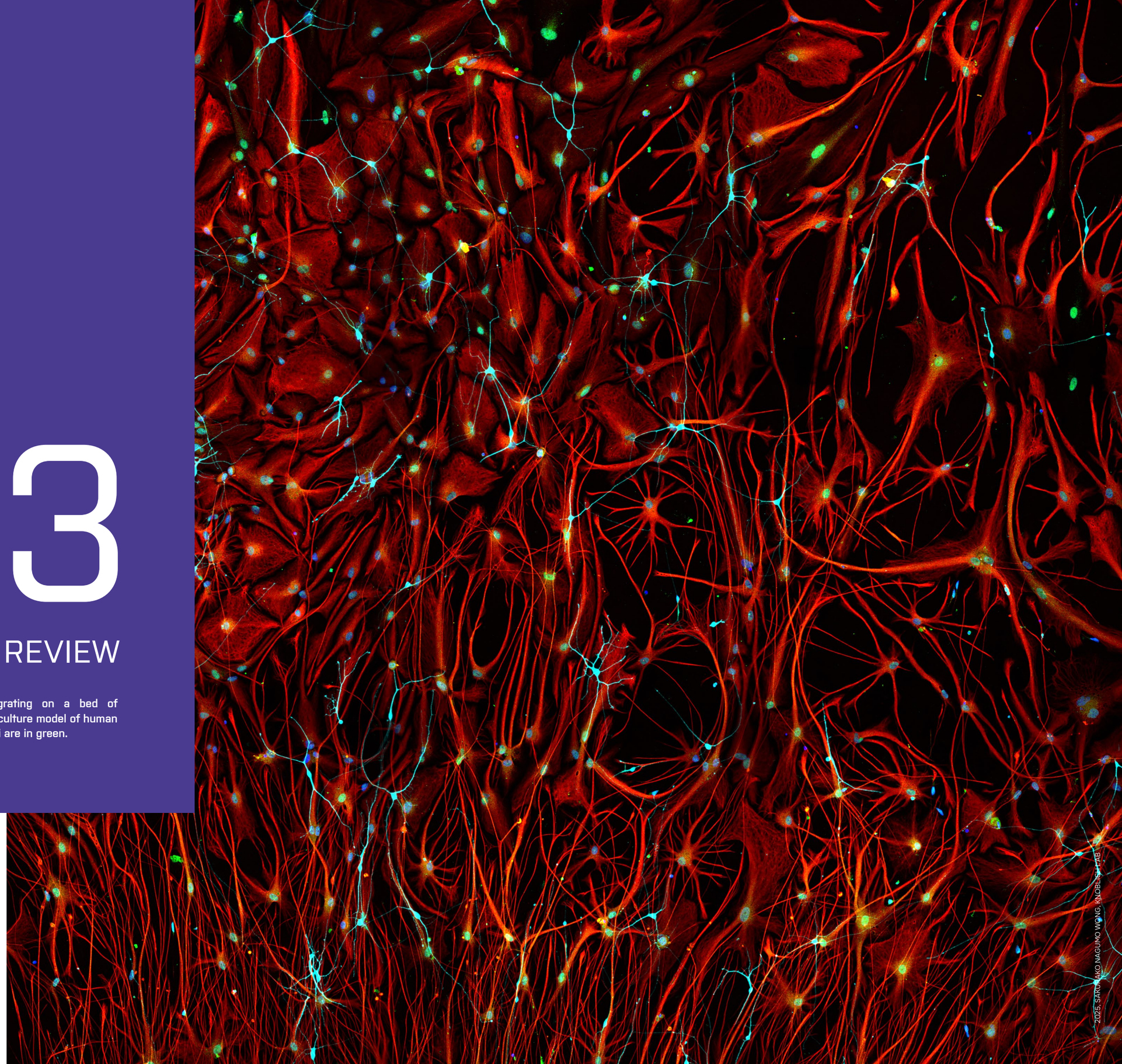
Explore the people and platforms that power research at IMBA. Visit our Services and Facilities page to learn more.



03

2025 IN REVIEW

Interneurons (cyan) migrating on a bed of astrocytes (red) in a cell culture model of human brain development. Nuclei are in green.



2025, SAKO, AIKO NAGUMO WONG, KNOBLICH LAB

Building the future

ADAM COOPER

Christian Lehmann, a PhD student in the Knoblich lab, graduated in 2025 after defending his dissertation, “Characterization of late arising EGFR progenitors in human cerebral organoids using neurospheres and their role in H3G34R pediatric gliomagenesis.”

The space between intuition and proof

Elly Tanaka’s Wittgenstein Award, Austria’s leading research prize, isn’t just recognition. It provides the freedom to pursue the kind of exploratory work that traditional grants would not support.

When the call came that she’d won the Wittgenstein Award, Austria’s most prestigious research prize, Elly Tanaka was in a meeting, so she didn’t pick up. When they finally reached her, for a moment her mind went blank. Not from shock, but from the sudden realization of what this meant. This award and its 1.9 million Euro endowment over five years isn’t just recognition for past achievements. What sets this award apart is the difference between what traditional research funding requires and what exploratory science actually needs.

KLAUS RANGER

Elly Tanaka at the Austrian Science Awards 2025 at Vienna City Hall; behind her from left to right Federal Minister for Women, Science and Research Eva Maria Holzleitner, FWF Executive Vice President Ursula Jakubek, and FWF President Christof Gattringer

The gap that traditional funding doesn't fill

Most research grants require that you have everything in place: preliminary data, clear milestones, proof you already know where you're going. But some of the most important science doesn't work that way. "You don't have all the pieces together yet," Tanaka explains, "and you know that this is something very interesting and important, but it's going to take some time to demonstrate it to the community."

> **"You don't have all the pieces together yet and you know that this is something very interesting and important, but it's going to take some time to demonstrate it to the community."**

Work like this has been simmering in Tanaka's lab for years. "Strains of work that link more to mammals or to diseases that we actually are not so well known for," she says. Her axolotl research has demonstrated that regenerative organisms can implement developmental signaling at adult scale. Now she wants to explore whether it's possible to break the limits of embryonic signaling in mammals and promote pattern formation at adult scale in mammalian systems. This research connects axolotl discoveries to mammalian biology, to human disease, and potentially to startup applications. "It is a phase of experiments that have slightly more connection to societal impact."

The foundation that makes it possible

In the early years of her lab, working with axolotls meant relying on fairly non-molecular techniques like histology and tissue grafting, transplanting tissues from darkly pigmented animals to lightly pigmented ones to track what happened during regeneration. Over time, Tanaka's team shifted the approach as modern molecular techniques became readily available, using cell type-specific promoters to drive gene expression in particular tissues and applying CRISPR technology and transgenesis to determine gene function in regeneration. This work culminated in a major milestone in 2018, when Tanaka and her team decoded the axolotl genome, one of the largest and most complex genomes sequenced at that time.

1996

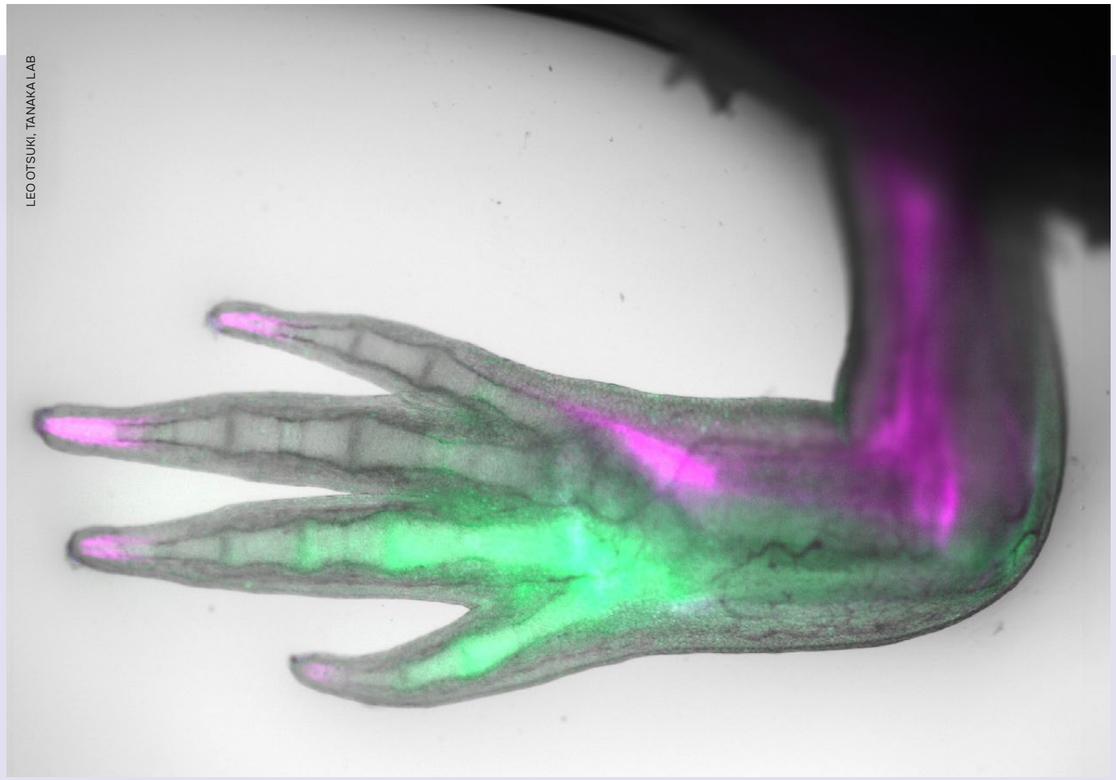
the year the Wittgenstein Award, now Austria's most prestigious science prize, was established

Those researchers and the advances they made possible are why Tanaka views this as a shared honor. "All those people who have been so sincere in that effort, the award goes to them," she says. The collaborative culture they helped build now extends beyond the lab.

Investing in the next generation

The Wittgenstein funding allows Tanaka to support the next generation of scientists at an even earlier stage, long before their research careers have begun. Tanaka plans to support the neugierige.koepfe project led by postdoctoral researcher Helena Okulski, a program that brings the science and experiments of axolotl regeneration to primary schools in Vienna. "The transformation this project has created, both for the students and for the scientists involved, has been amazing to see," Tanaka says. "Supporting this kind of outreach is exactly what this funding should be used for." [Learn more about this project as part of our coverage of outreach.]

Receiving this recognition has also shifted something in how she sees herself and her position in the field. "Maybe I should take myself a little bit more seriously," she jokes. For five years, she'll have the freedom to do exactly that.



LEO OTSUKI, TANAKA LAB

Tanaka's team recently identified the gene *Hand2* as the key factor telling cells in the axolotl arm where they are and what structures to rebuild after injury. Their findings were published in the journal *Nature* in May.

Wittgenstein Award

The FWF Wittgenstein Award is Austria's most prestigious and most highly endowed scientific research prize, conferred annually since 1996 by the Austrian Science Fund (FWF) on behalf of the Federal Ministry for Science. It recognizes distinguished researchers across all disciplines who occupy a leading place in the global scientific community. The award provides funding of around two million Euro over five years to pursue long-term, high-impact research with maximum freedom. Selection is by an international jury following nomination from senior academic leaders.

FWF Austrian Science Fund

The courage to be wrong 80 percent of the time

After receiving an Advanced Grant from the European Research Council, Sasha Mendjan asks his team for a commitment to pursue research where most attempts fail.

At his lab's tenth anniversary celebration this year, Sasha Mendjan gathered current team members and alumni to mark a decade of breakthrough work. The lab pioneered the development of chamber-like cardioids, the first models capable of mimicking a developing human heart's structure, enabling researchers to study early cardiac developmental defects and adult myocardial diseases in ways that weren't possible before. The work even led to an IMBA spin-out, HeartBeat.bio, now developing the technology's translational potential.

Yet in his remarks, Mendjan didn't dwell on these scientific achievements. He focused instead on what had mattered most to him: his team's courage and their willingness to pursue ambitious questions during the prime years of their careers. Now, with a 2.5 million Euro European Research Council (ERC) Advanced Grant, he's asking his team for five more years of exactly that kind of courage.

Building an adult heart model

The grant supports an ambitious goal: creating a regenerating, adult-like human heart model. Current cardioids are less than a millimeter in size, perfect for studying early development, but too small to model adult diseases like heart failure.

Scaling up these models isn't just a technical challenge; it's an urgent medical need. According to the World Health Organization, cardiovascular disease causes approximately 17.9 million deaths annually, more than all cancers combined. Despite this burden, drug development has lagged in part because animal models don't reliably predict human responses to therapies. A physiologically accurate adult human heart model could provide a more predictive platform for testing treatments and address a fundamental question: why fetal hearts can regenerate damaged tissue while adult hearts cannot, and whether that capacity can be restored.

Even intermediate milestones would advance the field significantly. Demonstrating media perfusion through the vessels already present in cardioids, or achieving increased levels of proliferating cardiomyocytes, would open new avenues for understanding human cardiac regeneration.

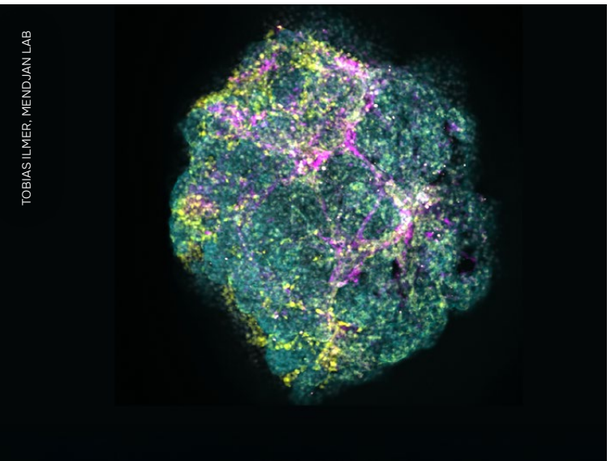
The work ahead requires overcoming multiple technical hurdles: achieving functional vascularization, growth to physiologically relevant size, and understanding what makes regeneration possible. It's a daunting challenge, but Mendjan has a philosophy about how to approach problems this complex.

Following development's blueprint

The philosophy is simple: don't try to engineer a heart from the top down. That approach assumes you know every component perfectly, like trying to build a plane when you understand 95 percent of the parts, but five percent are still missing. Instead, Mendjan's lab follows developmental principles. The cells already contain the instructions to build a heart; the challenge is creating the right conditions to allow those built-in programs to unfold.

"When we began this work, what we were more certain of," Mendjan explains, "was that if we followed principles faithful to developmental mechanisms employed by embryos, we would also be successful in the dish."

The discovery of cardioids themselves came from an unexpected moment. The team was running an experiment with a different hypothesis entirely: they wanted cardiomyocytes to attach more firmly to the plastic dish, so they added an extracellular matrix protein to the media at a specific developmental stage. Instead of cells attaching to plastic, they self-organized into a chamber.



TOBIAS ILMER, MENDJAN LAB

The Mendjan lab develops cardiac organoid (cardioid) technology to understand human heart development and disease. Left ventricle (LV) cardiac organoid invaded by macrophages (CD68, yellow); endothelial cells (CD31, magenta); nuclei (DAPI, white); cardiomyocytes (TNNI1, cyan).

ANNA STÖCHER

25 **grants from the European Research Council have been awarded to IMBA researchers since 2007.**

"We were already very close without knowing it by pushing in this direction and aligning many other factors with embryonic development," Mendjan says, "and by simply trying out one new factor at one condition, one of these elements tipped us over the edge of discovery."

The discovery illustrates the power of this approach: systematic work aligned with developmental principles, combined with the willingness to try new conditions, can tip a project from incremental progress to breakthrough.

Eighty percent of things won't work

The cardioid discovery stands out precisely because such moments are exceptional. The reality of this work is different, Mendjan tells his team frankly, and is the reason this work demands courage. "Eighty percent of the things you do are not going to work," he says. "It's not just you. It's actually difficult to do this."

The "things" that fail are often small but critical steps in the research process: a particular reagent isn't sensitive enough for the assay, suitable computational methods don't yet exist for high-throughput analysis, or the timing simply isn't right. These are the everyday technical challenges that determine whether a new methodology works or needs to be abandoned and reimagined. But each failed attempt narrows the path toward what will work, systematically eliminating approaches that don't succeed.

Acknowledging this difficulty upfront serves a purpose. PhD students and postdocs typically spend three to five years on a single project during their twenties and early thirties, years that are important for their career trajectory. Understanding that most experimental approaches won't succeed, but that this is inherent to the work rather than a reflection of the researcher, is part of the commitment from the start.

The ERC Advanced Grant is designed for exactly this reality. It supports high-risk, high-gain science by funding multi-year personnel support, equipment, and the resources to pursue various experimental approaches. For Mendjan, however, the most critical resource isn't equipment or funding, but the team itself.

"The process is the goal. The courage my team develops, the skills they build, the questions they learn to ask: those matter regardless of where the science leads us."

What matters along the way

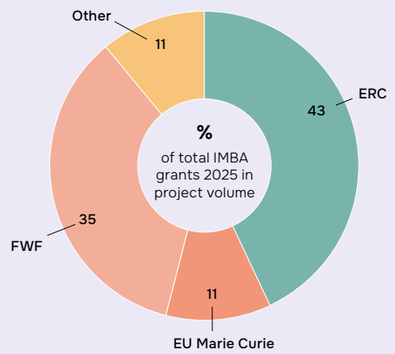
For work this uncertain, Mendjan is adamant that courage isn't something you develop alone. "Courage is something that comes from working in a team," he explains. "If you feel that you're not alone on the quest, that you're working together with two or three other people who have the same goal, you learn a lot from them." It's not just about learning, he notes. Teams also provide support when times are hard and inspire each other to come up with new ideas when one approach stalls.

The upcoming five years will test whether they can push cardioid technology to the next frontier. For Mendjan, success isn't defined solely by reaching that goal. "The process is an important part of the goal," he says. "The courage my team develops, the skills they build, the questions they learn to ask: those matter regardless of where the science leads us."

World Health Organization. (n.d.). Cardiovascular diseases. Retrieved from https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1

RESEARCH GRANTS

IMBA's scientists secure grants that evaluate ideas for scientific originality and long-term impact, supporting research that enables them to pursue high-risk questions and fundamental discoveries.



Data as of 31 December 2025

Wisdom, borrowed and otherwise

The IMBA community shared quotes that define how they think and work. From the profound to the profane, no one held back.

Every lab, every hallway, every coffee break has a soundtrack of borrowed wisdom: the lines people repeat to themselves when the experiment fails, when the data surprises, or when they just need a push to start. This year, we sent out a survey asking IMBA researchers to share the quotes, sayings, or favorite lines about science and discovery that inspire their work. The goal was simple: let the community speak for itself. What came back is a mix of voices famous and anonymous, advice both elevated and earthy, and a couple of contributions that we probably shouldn't print but absolutely will.

Christian Deschka's *The unexpected result of an euphoric relationship* (2008/10) is a series of 36 vector graphics depicting transformed pixel based scientific imagery, displayed as a linear wall installation at IMBA.

Behind the scenes of funding acquisition

One applicant shares what the final hours of a grant deadline actually look like from the inside.

Scientific breakthroughs make headlines. Grant applications don't. Yet the invisible work of securing research funding has become its own high-stakes discipline. For every discovery that reaches a journal, there are months of grant-writing, budget justifications, and sleepless deadline nights that no one outside academia ever sees.

The pressure is intensifying. A 2025 report in the journal *Nature* found that application volumes at some major European funders have nearly doubled since 2017, while success rates have dropped dramatically. In certain funding schemes, such as the UK Research & Innovation fund, rates have plummeted from 36 percent to just 19 percent. More researchers are competing harder for relatively fewer grants, and each deadline carries greater weight. In the fall of 2025, Emmanouella Chatzidaki Trinks, Head of Scientific Affairs at IMBA, lived through one such deadline, racing to submit a consortium grant application to an Austrian funding body. What follows is her account of those final hours, told through her internal monologue.

ADAM COOPER

Emmanouella Chatzidaki Trinks, Head of Scientific Affairs at IMBA, during an event in 2024

Act 1: The night before

My eyes are blurring after having stared intensely at the bright screen for hours. "I need glasses," I think to myself.

I'm eating toast with Nutella, chugging down my beloved homemade filter coffee, knowing full well that coffee has no influence on my brain chemistry other than relaxing the muscles that have tensed up after hours of sitting. But Nutella! Pure fuel! When my energy runs out, we're done for the day, and there is **no way** we can be done yet. So if Nutella buys me a bit more time with my computer, that's exactly what we'll be doing.

I eat over my laptop because putting the toast on a plate would require standing up, and standing up means losing my train of thought, which means the entire Aims Pitch of this proposal might collapse like a house of cards.

I look up. Five hours are gone already.

Small defeat. In my dreams, items 1 through 7 (out of 12) on my to-do list would already have been done five hours ago. But "introductions" can be tricky beasts to tame, especially when Aim 4 is a moving target. All those sentences, and all their many variations, bear witness to multiple desperate attempts to finally finish this section. Yet what is left are signs of hard but incomplete work that I should have tidied up **an hour ago.** Words full of science history compete for a place on the final score… Oh, which to pick, and in what sequence, to convey everything the reviewer might want to know? What will win me the "outstanding" (formerly known as "excellent") grade? Will this one, or that, work best? "Decide, decide," orders my brain in a war-march tone. My mind flickers at the pressure, but I quickly touch the light switch and steady the flow of organized thoughts. "Go over the strategy once again. Stick close to the story and you will be fine. Focus. Execute."

> **"I eat over my laptop because putting the toast on a plate would require standing up, and standing up means losing my train of thought."**

Checking the text one last time before I send an email update to the team promising to do the final tasks the next morning. How many times will I attempt to clear my memory in an attempt to experience the grant with fresh eyes, only to fail and repeat again expecting a different outcome? Like trying to clear your nose with coffee beans at a perfume counter, only to discover that some aldehydes from the previous scent linger stubbornly.

Act 2: Seven hours to go

A few short hours of sleep later, "tomorrow" has morphed into "today."

An email notification pops up. It's from the funding agency; an automated reminder that the deadline is in seven hours. "You don't say!" I exclaim, eyes at half-mast. As if I could forget. As if the countdown timer in the corner of my screen isn't already burned into my retinas. The cursor blinks at me. Mocking. Don't give in, I tell myself. My thoughts march in and pull me out of my misery; my brain returns triumphant to the keyboard.

I found a typo in Aim 2. A TYPO. I have read this document 47 times and there's still a typo. I laugh-cry. Words dance before my eyes like vengeful spirits seeking release. I call all brain cells to a general assembly and announce the next steps: "Take 9 of finalizing Aim 4. Change sub-aims accordingly. Adapt model, too. Go back and edit cross-references to fit new Aim 4. Adapt abstract to match. Adapt synopsis. Adapt graphical abstract. Refresh table of contents and reference list. Run sanity check. Cross-check budget and justification. Italicize Latin words correctly to prove I went to university, and remember to 'breathe in-breathe out' through my desperate fight to strike through what remains on the to-do list faster than the arrow racing toward the deadline."

> **"Words full of science history compete for a place on the final score …"**

It's noon on D-day.

One letter of collaboration is still outstanding. Another email comes in. The collaborator asks for an explanation of the model used in Aims 3 and 4. We have four hours left. FOUR HOURS. What I want to say is: "Lady, I have no time to explain the model. I have four hours to go, and that translates to about three seconds in looming-deadline-breathing-down-your-neck talk. Please sign on the dotted line and walk away slowly." Instead, I offer a decent explanation. One hour later, the signed letter arrives. I add it to the proposal and start the final sequence ritual.

Act 3: The submit button

I convert my long Word document into PDF format and admire the final product of my labor.

The PDF fails to open. My weekly license has run out. I freeze in shock. One, two, three seconds pass. I snap out. I use Preview instead. I follow with multiple iterations to fix the word-to-PDF "lost in translation" situation. I check the documents. And I check them again. I upload all remaining files.

That's it. The moment has come. **The submit button beckons.** I oblige and watch the bytes take off like Santa Claus on his sleigh, hauling promises of "grant deliverables" for presents, all neatly plotted on the Gantt chart that every funder demands, and which I begrudgingly had to draw.

I can finally rest. I stand up to move the submission out of my body; my knees protesting. I close my eyes. Silence, the sound of focus, still fills my ears. The high is still there, but fading. My shoulders drop just a bit. The shackles of time, lost grain by grain, finally loosen their grip. I step out of my bubble as normal life seeps back in.

"I found a typo in Aim 2. A TYPO. I have read this document 47 times and there's still a typo."

The aftermath: Why do I do this?

What's amazing about academic research is that, "at the bench," you get to see the data for the first time. You can be the first person to know one of nature's secrets. While I'm not the one at the bench, my job is to fight for the resources that enable others to do their research. "At the desk," I get to dream about how you, my colleagues, will get there before you even know about your future journey. I often cheer in anticipation of your success, my eyes glistening at the prospects of what your work will mean for you as a scientist and for everyone who benefits from the discoveries.

Emmanouella hit submit. The countdown stopped. Many months would pass before the funding decision arrived, and when it did, the answer was yes! But between every scientific discovery and the tools that enable it, there's a moment like this one: a researcher, a deadline, and everything on the line. The breakthroughs will come. First, someone has to fight their way to the submit button.

Naddaf, M. (2025). Is academic research becoming too competitive? Nature examines the data. *Nature, 646*, 1036–1037. https://www.nature.com/articles/d41586-025-03119-z

Funding highlights from 2025

Behind every award and grant application lie months of preparation, strategic planning, and high-stakes deadlines. In 2025, those efforts paid off for IMBA researchers.

25th
ERC Grant
secured by IMBA researchers

19
grants, prizes, & fellowships
secured by IMBA researchers

1
Wittgenstein Prize
Austria's highest scientific honor (Elly Tanaka)

9
fellowships
for students and postdocs

1/3
of IMBA's total expenditures are funded by
competitive grants

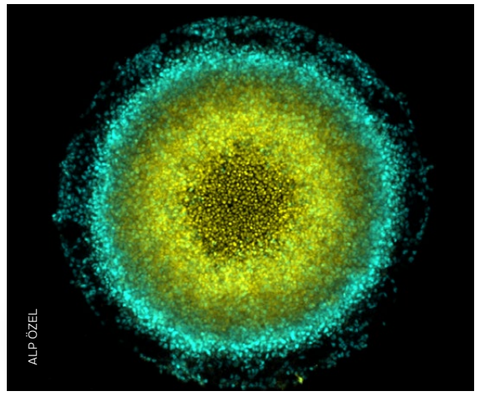
Chatzidaki Trinks (left) helped secure a Data Stewards grant from the Austrian Research Promotion Agency (FFG), independent of the work described here. The funding will support one of the newest and most data-intensive research areas on campus. Also pictured: Sven Klumpe and Artem Kushner

Explore the funding, awards, and supporters that make IMBA's research possible.

Unpacking the lab– and the questions

New Group Leader Kristina Stapornwongkul explains what happens before the first experiment.

ANNA STÖCHER



ALP ÖZEL

Stapornwongkul's lab uses human stem cell models to study metabolism's role, not just providing energy, but how it affects cell fate decisions, tissue formation, and developmental robustness.

"You get really excited when you see pipettes," Kristina Stapornwongkul laughs. "These are our pipettes. It's amazing."

As a new Group Leader at IMBA, Stapornwongkul can finally unpack with her team in their permanent lab space. After months in temporary rooms waiting for construction and moving between spaces, it's the pipettes that make it real. It's a small moment, but symbolic: unpacking physical equipment means unpacking what it means to build a research group from scratch.

Stapornwongkul arrived on September 1, in time to attend IMBA's annual recess in October, where every group leader presented their work to a packed room. "It was really a celebration of the science happening in this place," she recalls. "I've never seen that before." That collective energy, and the message that science here is a shared endeavor, demonstrated the culture that had attracted her to IMBA.

Building with intention

Before she could unpack boxes, Stapornwongkul had to build her team, beginning with her first hire: Senior Research Assistant Ho Yee Chan, who also acts as lab manager. Chan brings scientific credentials backed by strong communication skills and a proactive approach to teamwork.

> **"You have to adapt to the people in the lab. Some need close supervision; others want to be left alone. The important thing is creating an environment where people can say how they want to be mentored."**

Setting the right tone requires a deliberate approach from the start. During onboarding, Stapornwongkul does something that she says "might sound a bit artificial": a formal discussion about lab culture and values. Things like scientific integrity and creating a supportive environment feel obvious, "so it's sometimes difficult to bring them up," she says, but making it explicit from day one creates a foundation.

Her mentorship philosophy builds on this intentionality. "You have to adapt to the people in the lab," she explains. "Some need close supervision; others want to be left alone. The important thing is creating an environment where people can say how they want to be mentored."

The hidden driver

This carefully built team will tackle a fundamental question: how do metabolic processes influence embryonic development? Stapornwongkul's lab uses human stem cell models to study metabolism's role, not just providing energy, but how it affects cell fate decisions, tissue formation, and developmental robustness. She is developing biosensors to visualize these processes in space and time.

"If we really want to holistically understand embryonic development, we have to bring in metabolism more," she says. "At the moment, we're really lacking this." The implications extend beyond fundamental biology. Understanding metabolism's role could illuminate pregnancy loss and developmental defects, as well as improve organoid culture conditions.

> **"I've always liked being involved in many people's projects, not doing their experiments, but discussing their projects. Now I get to do more of that."**

Finding the right fit

The adjustment to leading this work feels surprisingly natural. "I really like the switch toward working in a team rather than being alone on a project," she reflects. "I've always liked being involved in many people's projects, not doing their experiments, but discussing their projects. Now I get to do more of that." She embraces the responsibility. "When people put their trust in you, it motivates you to create the best environment for your team," she says.

The boxes are unpacked now, the pipettes in their drawers. The team is small but assembled, the culture deliberately set, the questions clear. Stapornwongkul is recruiting postdocs and PhD students for the future, but right now, in this permanent space with this new team, the feeling is simple: "We're just very excited to get started."

Science meets classroom

Helena Okulski brings IMBA's research to Vienna's primary schools through neugierige.köpfe, an outreach initiative she launched at IMBA that transforms participating scientists in the process. 78

The conversations that only happen when everyone's in the room

The Health Science Forum, a cooperative partnership between IMBA and Merck Austria, creates rare dialogue between researchers, pharma, policymakers, and patients, proving that complex science calls for collaborative conversations. 80

The questions they didn't plan for

At the Daughters' Day event at the Vienna BioCenter in April, the best-laid plans gave way to something better: authentic dialogue leading to lasting connections. 82

Connecting with society

IMBA engages with society through outreach programs, education initiatives, and dialogue with partners across science, policy, and industry.

IMBA views outreach as a vital form of dialogue: informing the public about the ways it spends public funds on fundamental research while actively listening to members of society and incorporating broader perspectives. Through outreach, the interested public has the opportunity to learn about IMBA's research while the institute's scientists become stronger communicators across a broad range of audiences.

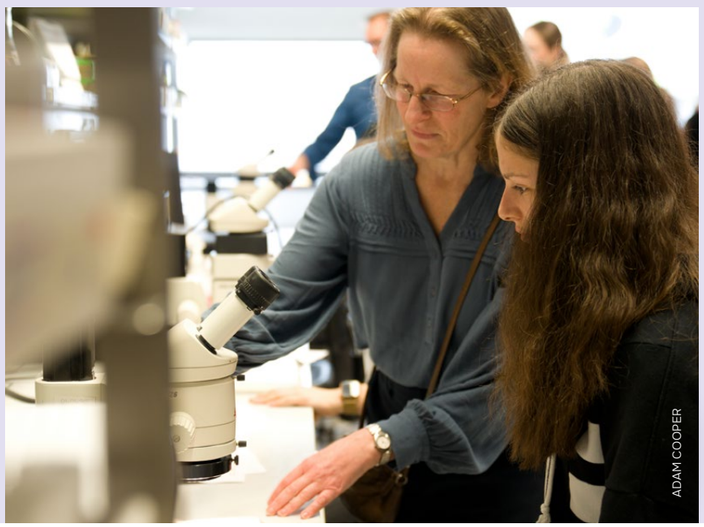
In 2025, IMBA connected scientists with public audiences through 25 programs spanning festivals, school workshops, and institutional visits, during which researchers shared insights into stem cell biology, developmental biology, and biomedical research. This was 2025 in outreach.

①

Daughters' Day

career exploration program
20 participants

Students visited IMBA to learn about careers in biomedical research and explore the daily work of scientists. Pictured here is Lisa Meadows from the Vienna Drosophila Resource Center, a Vienna BioCenter Core Facility that supports research on campus, including at IMBA. Read the feature story in this chapter.



ADAM COOPER

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②

Wiener Forschungsfest

public science festival
14,000 visitors

At IMBA's research station in Vienna's city hall, visitors explored stem cell research, including how axolotls regenerate limbs and how different cell types function.

Explore how IMBA engages with society through events, dialogue, and outreach.

3

Neugierige.Köpfe

school outreach workshops
127 participants in 2025

Through the neugierige.koepfe initiative, IMBA researchers brought current life science research directly into classrooms across Vienna. Read the feature story in this chapter.

4

Simons Science School visit

international student program
30 participants

IMBA welcomed Ukrainian Chemistry, Math, and Physics Olympiad winners who were preparing for international competitions or pursuing advanced training in science.

5

ÖAW KinderUni Day

youth education program
24 participants

As part of a program that brings together around 4000 children across Vienna, students explored molecular biology in an IMBA-led workshop, examining their own oral mucosa cells under the microscope and creating model cells to take home. Pictured here is Christian Krauditsch.

6

Health Science Forum Vienna

science policy dialogue
100 participants

IMBA researchers joined experts from academia, politics, and industry to discuss emerging developments in biomedical research and their implications for healthcare and society. Find the feature story in this chapter, including insights from Leif Moll, then Managing Director of Merck Austria.

Science diplomacy

Visits mobilize the community in different ways. Presentations get updated, rooms are booked, and lab tours are organized. Typically, management, specific researchers and facilities, the scientific secretariat, and the communications team are involved. In 2025, IMBA welcomed 14 funding bodies, research institutions, group leader candidates, and government organizations, including delegations from abroad and the recently appointed Federal Minister for Women, Science and Research. Topics focused on cooperation, scientific exchange, and translational work. These are the visitors IMBA hosted; in addition, IMBA's work is also conveyed in similar visits organized by the Vienna BioCenter.

ADAM COOPER

City leadership

Vienna City Councilor for Cultural Affairs and Science Veronica Kaup-Hasler visited IMBA to learn about blastoid and regeneration research and to connect with scientists working in Vienna's publicly supported research system. She is pictured here with Marlene Müller (Rivron lab).

Scholarly guidance

The ÖAW Research Board supports the Academy in advancing research at its institutes, including IMBA, by advising on the research program and, together with the Presiding Committee, setting guidelines for academic quality control.

Government, funding, and institutional visitors

- Dr. Michael Häupl, President of the Vienna Science and Technology Fund (WWTF)
- Eva-Maria Holzleitner, Federal Minister for Women, Science and Research
- Veronica Kaup-Hasler, Vienna City Councilor for Cultural Affairs and Science
- Research Funding team, Federal Ministry of Women, Science and Research
- Koo Hyuk Chae, Vice Minister of Science and Information and Communication Technology of Korea

Research and science organizations

- Centre for Genome Engineering, Daejeon, South Korea
- Korea Advanced Institute of Science and Technology (KAIST)
- Austrian Academy of Sciences (ÖAW) Research Board

ADAM COOPER

Industry insights

Life sciences is one of Vienna's major strategic sectors for industry and innovation. During a visit organized by Industriellenvereinigung Wien, Sasha Mendjan, Group Leader at IMBA, presents some of the institute's research to representatives of Vienna's business community.

Industry and innovation networks

- Vienna branch of the Federation of Austrian Industries (IV Wien), working group "Wien 2030: Wirtschaft und Innovation"
- XISTA management: Markus Wanko, Alex Schwartz, Prue Donovan
- Management Assistants of Boehringer Ingelheim Regional Center Vienna (BIRCV MTA)
- Delegation of the Europe Korea Conference on Science and Technology Industry Forum
- Lions' Club Baden-Helenental

The story continues: In 2025, IMBA and the IMP hosted scientific meetings that brought over 1000 researchers from around the world to the Vienna BioCenter to discuss molecular biology, stem cell research, and developmental biology. **Find out more about them in Fabric of Discovery, the report on joint activities of IMBA, the IMP, and the wider Vienna BioCenter.**

Meet the policymakers, funders, and institutional partners who visit IMBA and shape the research environment around it. Explore who they are and why they come.

Science meets classroom

Helena Okulski brings regeneration research to Vienna's primary schools through neugierige.köpfe, an outreach initiative she launched at IMBA that transforms participating scientists in the process.

When Helena Okulski rings the bell to signal rotation time, 20 pairs of eager eyes look up from microscopes and pipettes. "Oh no, it's over already?" That moment, when eight-year-olds are so deeply engaged in exploring axolotl regeneration that they don't want to stop, captures what happens when science becomes accessible.

> **"The curiosity and openness at that age is what matters."**

Okulski, a postdoctoral researcher in Elly Tanaka's lab, had the idea for neugierige.köpfe ("curious.minds") after attending events like the Long Night of Research. She observed that these public festivals primarily attract families of children who already have access to science education and exposure to research. "But what about all the other kids?" she wondered, "how can we reach them?" Her solution was to bring science directly to them.

500+

primary school students across more than 20 Vienna schools received visits from the neugierige.köpfe program in the 2025 school year

Designing for discovery

The in-classroom workshop is free, requires no teacher preparation, and delivers hands-on discovery. Students rotate through three stations: observing live axolotl eggs and early larval stages using display microscopes, practicing laboratory pipetting techniques with colored water to represent cell culture medium, and assembling puzzles that reveal how long regeneration actually takes and what happens at the cellular level.

At each station, students write or draw their observations without being told what they should see. "There is no wrong or right; kids simply explore," Okulski explains. "The curiosity and openness at that age is what matters."

Axolotls are studied in the Tanaka lab to understand how animals regenerate complex tissues such as limbs and spinal cord. In the neugierige.köpfe workshops, primary school students can observe axolotl embryos and early larval stages under the microscope and explore the biology of regeneration firsthand.

Learning to translate

The workshops also transform the researchers who deliver them. The scientists already possess the knowledge and skills, but the classroom setting requires a different kind of communication. "When they speak to children, their enthusiasm is no longer framed by academic language. It becomes alive and intuitive," she says.

> **"When they speak to children, their enthusiasm is no longer framed by academic language. It becomes alive and intuitive."**

The transformation shows up in subtle but meaningful ways. Scientists learn to translate complex concepts into engaging, accessible language. They listen more attentively to questions, respond more flexibly to spontaneous inquiries, and adjust their explanations intuitively based on what children actually understand. "There were many instances where a child asked a very direct question, sometimes surprisingly simple, sometimes unexpectedly profound," Okulski recalls. "Instead of giving overly technical answers, the scientists responded openly and thoughtfully, often rethinking their explanations in real time."

In 2025, Helena Okulski received funding from the Vienna Business Agency for neugierige.köpfe, bringing science into Viennese classrooms.

Follow @neugierige.koepfe on Instagram for axolotl biology, regeneration facts, and to meet the team behind the project.

These exchanges create genuine moments of connection that strengthen researchers' awareness of how their work resonates beyond academia. Many realize they can communicate their research effectively to non-expert audiences, which builds confidence for stepping outside purely academic contexts.

A model for expansion

The program recently received two years of funding from Wirtschaftsagentur Wien's "Wissenschaft verstehen" initiative, and demand confirms they've filled a genuine gap. In the 2025/2026 school year, they are fully booked with a growing waiting list and will visit over 500 students at more than 20 public schools across Vienna.

IMBA Scientific Director Elly Tanaka has watched the culture shift. "While everybody says outreach is important, recruiting people away from bench science is often not easy. But what Helena has done is so amazing that everybody is really on board."

Okulski is working with researchers from other groups to translate their science into the format and expand the workshops beyond axolotls and regeneration research. Overall, for Okulski, the measure of success remains simple. "The goal is for the kids to have a positive experience with science," she says. Judging by how eagerly they try to squeeze in one last look at the axolotls when the bell rings, that mission is working.

In the 2025/2026 school year, neugierige.köpfe workshops are fully booked and will visit over 500 students at more than 20 public schools across and beyond Vienna.

Only when everyone's in the room

The Health Science Forum, a cooperative partnership between IMBA and Merck Austria, creates rare dialogue between researchers, pharma, policymakers, and patients, proving that complex science calls for collaborative conversations.

When a pharmaceutical executive, a stem cell researcher, and a family caregiver look at the same health crisis, they see completely different problems. That disconnect can slow progress down when addressing urgent health challenges. IMBA's Health Science Forum Vienna seeks to bridge that gap.

"I talk to these groups one-to-one in my line of work," says Leif Moll, then Managing Director of Merck Austria, "but I don't very often bring them together so they can spark ideas off each other and learn from each other." Deliberately bringing people together is what the forum is all about.

Now in its fourth year, the partnership between IMBA and Merck Austria follows a clear model: identify topics where cutting-edge research intersects with pressing societal needs, then assemble stakeholders who rarely share a stage. Topics have ranged from mRNA vaccines to fertility medicine to neurodegenerative diseases. Each time, researchers present alongside clinicians, pharma executives, health economists, policymakers, and patient advocates. The result is dialogue that doesn't happen anywhere else.

Dr. Julia Ferrari, President of the Austrian Society of Neurology and Head of Neurology at the Hospital of the Brothers of Mercy, delivered the keynote address and emphasized that we have to look much earlier if we want to secure supply in the long term. Early diagnostics and prevention are crucial for reducing future healthcare burdens.

Why neurodegeneration, why now

On 20 November 2025, over 100 people from politics, science, patient organizations, health professions, and industry gathered at IMBA to grapple with a looming challenge: the fact that dementia cases are projected to double in Austria within the next 25 years.

IMBA chose this topic because it sits squarely at the intersection that the forum was designed to address. Basic research is making breakthroughs with organoid models while clinicians face mounting patient numbers. Health systems must plan for unprecedented care demands while families struggle with limited support. Each perspective is essential, yet they rarely inform each other. The forum bridges that gap.

"The partnership between the 350-year-old Merck and 23-year-young IMBA works because we ask the same questions," says Sylvia Weinzettl, Senior Relationship Manager at IMBA. "How are new findings changing our world, what are the ethical implications, and what needs to change?" It's in IMBA's DNA to reach out to the public, she adds, emphasizing the institute's dedication to engaging beyond the usual academic bubble. This commitment matters because such challenges call for collaboration across sectors.

> **"How are new findings changing our world, what are the ethical implications, and what needs to change?"**
>
> **Sylvia Weinzettl | IMBA**

When diverse perspectives meet

Each stakeholder saw a different urgent problem in the looming dementia crisis, and the forum's value lies in bringing those perspectives into genuine dialogue.

The clinical reality: Julia Ferrari, President of the Austrian Society of Neurology and Head of Neurology at the Hospital of the Brothers of Mercy in Vienna, showed how rapidly the number of affected people is increasing. "We have to look much earlier if we want to secure supply in the long term," she said.

The research breakthrough: Jürgen Knoblich, IMBA Group Leader and Deputy Director, presented brain organoids as tools to understand disease mechanisms. His lab has reconstructed the neuronal circuits relevant to Parkinson's disease in organoid models. "Our goal is to really understand the mechanisms," said IMBA Director Elly Tanaka. "Only then can we develop therapies that make their way into people's everyday lives."

The economic paradox: Health economist Ernest Pichlbauer highlighted a troubling gap. "We know dementia risk explodes after 65. Nevertheless, we invest far too little in primary prevention," he said. The dilemma is stark: Austria needs to pivot to prevention now, but doing so would offer little help for people already aged 55 to 70.

The caregiver reality: Birgit Meinhard-Schiebel, President of the Austrian Association of Caregiving Relatives, described the front lines. "Family caregivers are often the first to notice changes. They need rapid support for comprehensive diagnosis, which also ensures access to support services." This resource pool of family carers is finite.

The pharmaceutical perspective: Leif Moll described the industry's reality: high failure rates, promising compounds that fail in clinical trials, enormous development costs. Yet after years of setbacks, there is new momentum. "We must not underestimate the dimension of this challenge," he said. "At the same time, there is enormous power in prevention and research."

What cross-fertilization produces

Having all these voices together changes what everyone learns. For Moll's team, the impact is powerful. "It reminds us why it's worthwhile getting up early in the morning. There's somebody waiting for the results of our work," he says. For researchers, hearing from caregivers shifts their perspective on what "therapies that work in everyday lives" actually means. For policymakers and economists, understanding why it takes so much time to bring treatments to market provides essential context for healthcare planning.

Why it matters

Austria faces major challenges in neurodegeneration that require prevention programs, research breakthroughs, policy changes, and expanded care infrastructure. No single sector can address them alone. The forum's success lies not in reaching consensus but in building solidarity that emerges from shared vulnerability. "It's very likely that we could also become patients," says Moll. The looming crisis touches everyone, which is exactly why everyone needs to be part of the conversation. By creating the space where that conversation can happen, IMBA's Health Science Forum demonstrates what effective public engagement looks like.

> **"It reminds us why it's worthwhile getting up early in the morning. There's somebody waiting for the results of our work."**
>
> **Leif Moll | Merck Austria**

The questions they didn't plan for

At the Daughters' Day event at the Vienna BioCenter in April, the best-laid plans gave way to something better: authentic dialogue leading to lasting connections.

ADAM COOPER

Teams at Vienna BioCenter Core Facilities, IMBA, and the GMI organized the Vienna BioCenter's activities for Daughters' Day.

They'd prepared for silence. Instead, they got questions about vegan leather biotechnology and cellular research methods. Emilie Habetzeder (Communications Representative & Welcome Office Liaison at the Vienna BioCenter Core Facilities) and Sina Metzler (then Outreach Officer for IMBA & GMI Communications and Partnerships) had organized the Vienna BioCenter's activities for Daughters' Day 2025 with backup plans for everything: quiz cards, ice-breaker activities, strategies for teenagers who might freeze up around scientists. Then Daughters' Day began, and none of it was needed. The moment the girls sat down with researchers, the questions started flowing.

The format was deliberately informal. Round-tables instead of presentations, with researchers rotating through conversations every few minutes. "We tried to adapt to the people we're working with," Metzler explains. "Researchers could either pick up the ready-made materials we had prepared or design their own sessions." The flexibility mattered, as did inviting diverse voices to share not just their science but their personal stories.

Individual paths and surprising depth

The girls who participated came with varying levels of interest and preparation. "It was fascinating to observe the individuality of each girl," recalls Laura Kracht, Postdoctoral Researcher in the Knoblich lab, who took part in the program. "Some were there because their friends went, others wanted a general idea about the job, and others already had lab experience with clear future plans in science."

> **"This isn't time away from research. It's validation for why research matters. You can see what's coming, what interest there is, and that's invigorating."**
>
> **Emilie Habetzeder | Vienna BioCenter Core Facilities**

But their questions revealed real scientific engagement. "The girls were so in-depth with their interests," Habetzeder recalls. "It wasn't 'how do you become a scientist?' They were asking about specific cells or research methods." One girl was choosing between science and diplomacy. Another wanted to create vegan leather using biotechnology. For the mentors and organizers, meeting that curiosity required moving science out of abstraction and into lived experience.

Daughters' Day

The city of Vienna's Töchtertag (Daughters' Day) is an annual career-orientation initiative that invites school-aged girls to spend a day at a company to explore technical, digital, manual, and scientific professions. In 2025, around 5900 students visited one of the approximately 200 participating companies—including IMBA.

By sharing her own story and bringing in scientists from the institutes to mentor the girls, the organisers and volunteers worked to collectively demystify the "scientist" archetype. Pictured here is Helena Okulski, researcher in the Tanaka lab.

Making science within reach

For Metzler, the depth of the girls' questions made the mentoring interactions particularly meaningful. "It's incredibly powerful when teenagers realize that we have been in their shoes and that scientific pathways are rarely a straight line," she explains. By sharing her own story and bringing in scientists from the institutes to mentor the girls, they worked to collectively demystify the "scientist" archetype.

When a mentor shares that their career didn't start with a perfect grade, but rather with a childhood love for nature or natural curiosity about how the world works, students begin to see their own interests reflected in the professional world. "This interaction matters because it moves science out of the textbook and places it within their reach," Metzler says. "It proves that while many technical skills are required, a deep sense of curiosity is a very important foundation for a career in research."

"All these questions forced me to zoom out of my detailed way of thinking about experiments and reminded me that our research is not isolated, but connected to societal interests and real-world concerns."

Laura Kracht, IMBA

Researchers could either use the ready-made outreach materials prepared by the organizers or design their own interactive sessions for the students.

The unexpected benefits for scientists

According to Habetzeder, the collaboration creates mutual advantages for everyone involved. "This isn't time away from research," she emphasizes. "It's validation for why research matters. You can see what's coming, what interest there is, and that's invigorating."

Kracht found that the girls' questions forced her to step outside her routine thinking. "They asked: 'What did you study for this job?'; 'Is the job difficult?'; 'Why does the job matter?'" she recalls. "All these questions forced me to zoom out of my detailed way of thinking about experiments and reminded me that our research is not isolated, but connected to societal interests and real-world concerns," she says.

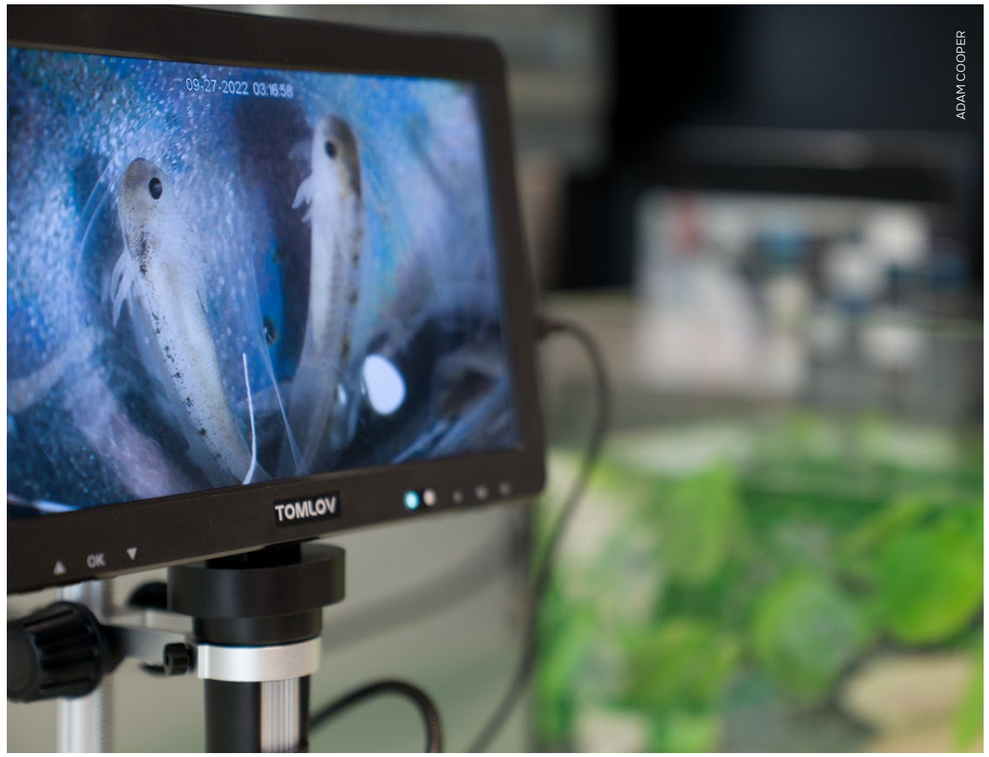
Building those connections required authenticity. As researchers shared stories about their work, why they do it, what they hope to discover, and the challenges they face, shy silences transformed into engaged conversation. "As women in science, we serve as role models by exemplifying that these girls, their perspectives and their creativity, are needed," Metzler says.

"It's incredibly powerful when teenagers realize that we have been in their shoes and that scientific pathways are rarely a straight line."

Sina Metzler, IMBA/GMI

That transformation became visible both during the event and after, as girls called months afterward asking about internships. For many participants, something fundamental had shifted. "It was inspiring to see that many girls left with a spark in their eyes for biology and science," Kracht says.

A deep sense of curiosity is a very important foundation for a career in research.



Ensuring safe research

How sharp is your lab safety radar?

The Environmental, Health, and Safety (EHS) team implements occupational health and safety measures that challenge us to rethink how the building operates and how research is done. The team is making a difference: disposable cups have been widely eliminated, and lab freezer temperatures were increased by 10 degrees to a new minus 70 degrees Celsius setpoint. Some things are less obvious, however, such as the fact that deliveries of lab materials occur once per week. In 2025, the institute was proud to receive an Ökobusiness Wien award in the category “excellent”.

EHS guidelines are designed to prevent precisely the situations shown in the laboratory scene below, which contains multiple deviations from standard practice at the IMP and IMBA. See how many you can spot, and check your answers by visiting the EHS webpage.

10°C

the rise in freezer temperature at IMBA to meaningfully reduce energy use

The EHS team coordinates safety and sustainability across IMBA and the IMP. Its members include Florian Grössl, Daniela Kostanova Poliakova, Maximilian Alexander Peer, and Amina Zankel (team lead).

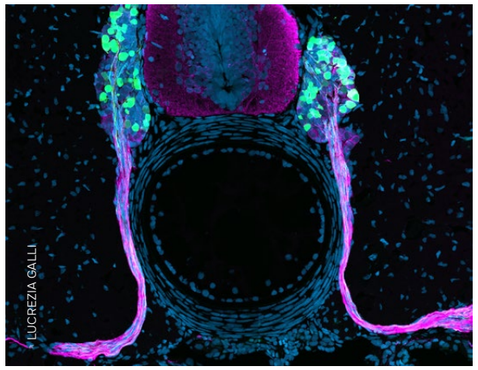
ACTIVITY: Circle all ten safety violations in this picture and check your answers online.

Visit the EHS page for the answers to the quiz, and explore the full range of work that supports safe, sustainable research at the IMP and IMBA.

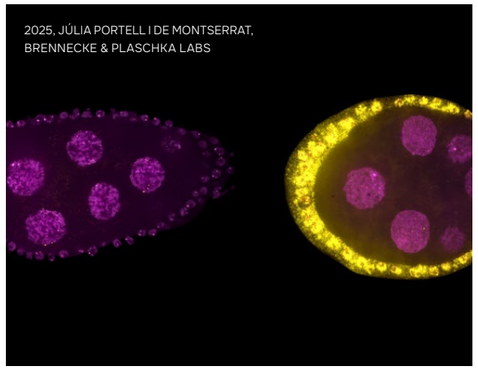
The Scientific Advisory Board

To maintain the highest standards of research, IMBA has installed a review and feedback process. The Scientific Advisory Board, consisting of internationally recognized scientists, meets yearly and, together with IMBA researchers, evaluates the quality, significance, and focus of research conducted at the institute.

Left to right: Scientific Director Elly Tanaka (IMBA); Deborah Bourc’his (Institut Curie, FR), Alexander van Oudenaarden (Hubrecht Institute, NL), Elizabeth Robertson (Sir William Dunn School of Pathology University of Oxford, UK), Denis Jabaudon, (Geneva University Neurocenter, CH), Maria Leptin Chair (European Research Council ERC, University of Cologne, DE), Iain Cheeseman (Whitehead Institute and Department of Biology, Massachusetts Institute of Technology, US)



Transverse section of the axolotl spinal cord with paired dorsal root ganglia. The image shows sensory neurons, labelled by a sensory-specific GFP transgenic line, and the pan-neuronal marker ßIII-tubulin.



Transposon expression (yellow) is silenced by PIWI in *Drosophila melanogaster* ovaries (left), but activates in the absence of PIWI and its partners (right).

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