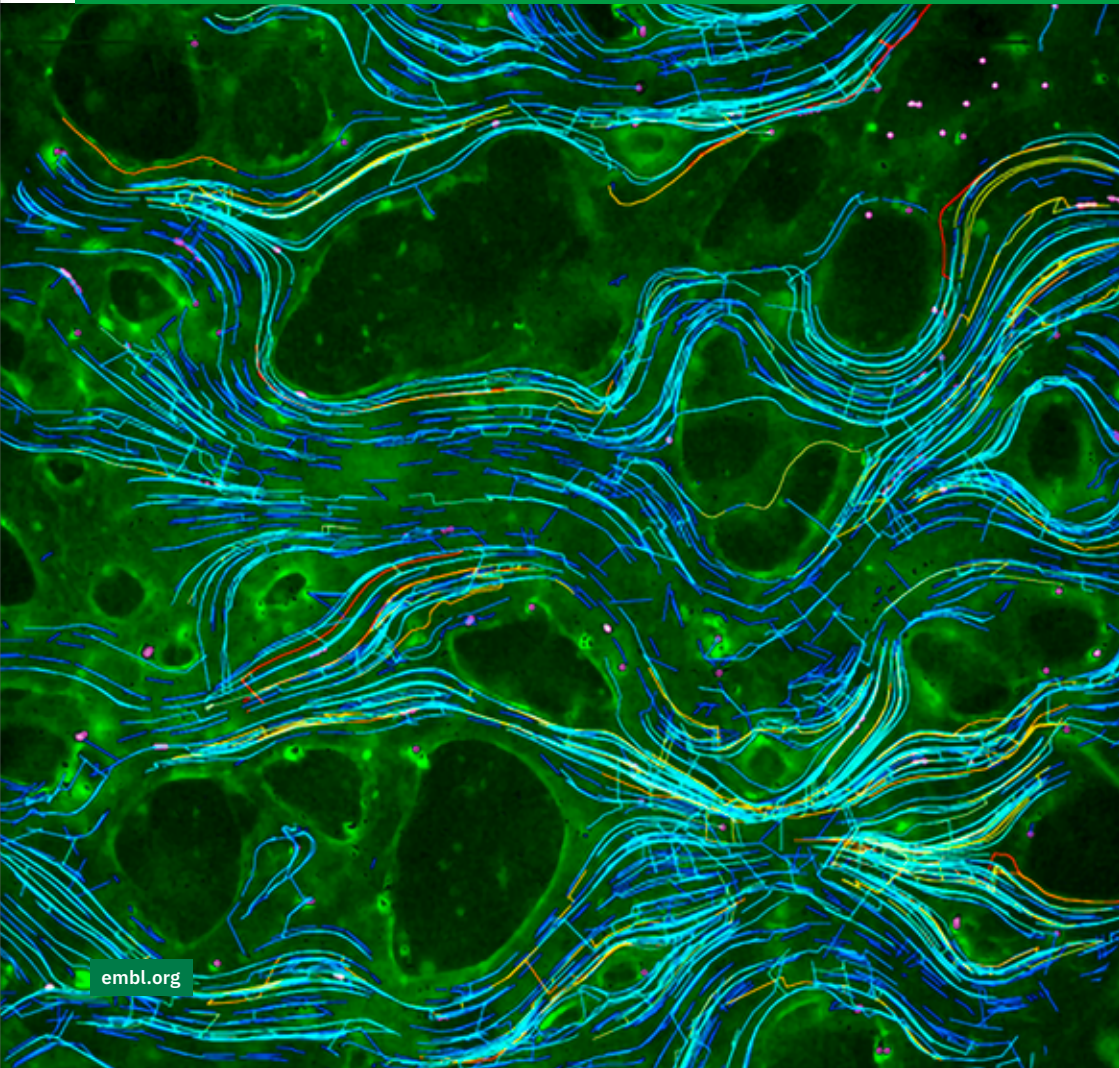


The European Molecular Biology Laboratory

Fundamental discoveries answering life sciences' most challenging questions



Europe's life sciences laboratory

Always at the frontier of the life sciences, EMBL is committed to advancing knowledge through its impactful fundamental research and providing tools and expertise to scientists in Europe and beyond who explore scientific questions at a molecular level.

With its current five-year programme, *Molecules to Ecosystems*, EMBL is applying its expertise to studying life in its natural context and exploring molecular mechanisms using fundamental discovery-driven research that can also address societal challenges.

Scientists at all career levels collaborate intensively and use EMBL's unique world-class technologies to move towards finding meaningful answers to challenging research questions. EMBL's six sites each contribute different kinds of expertise that foster this unique, collaborative atmosphere. It's why so many seek out EMBL as their scientific partner of choice and why early-career scientists want to learn in this dynamic environment.

Both within and beyond biological disciplines, experienced scientists value EMBL's leadership, perspective, and cutting-edge technology. It's a place to realise scientific visions and conduct next-level multidisciplinary research.

For the 29 member states that govern and fund this unique intergovernmental organisation, new talent and tools migrate home, elevating scientific capacity in these countries and building local alliances and remote partnerships. EMBL's alumni are a testament to this. Approximately 80% work in member states in positions that push the boundaries of knowledge – in academia, private research enterprises, entrepreneurial pursuits, industry, and education.

Likewise, industry is eager to work with EMBL's promising fundamental science discoveries to make formidable advances in medicine, agriculture, and other fields.



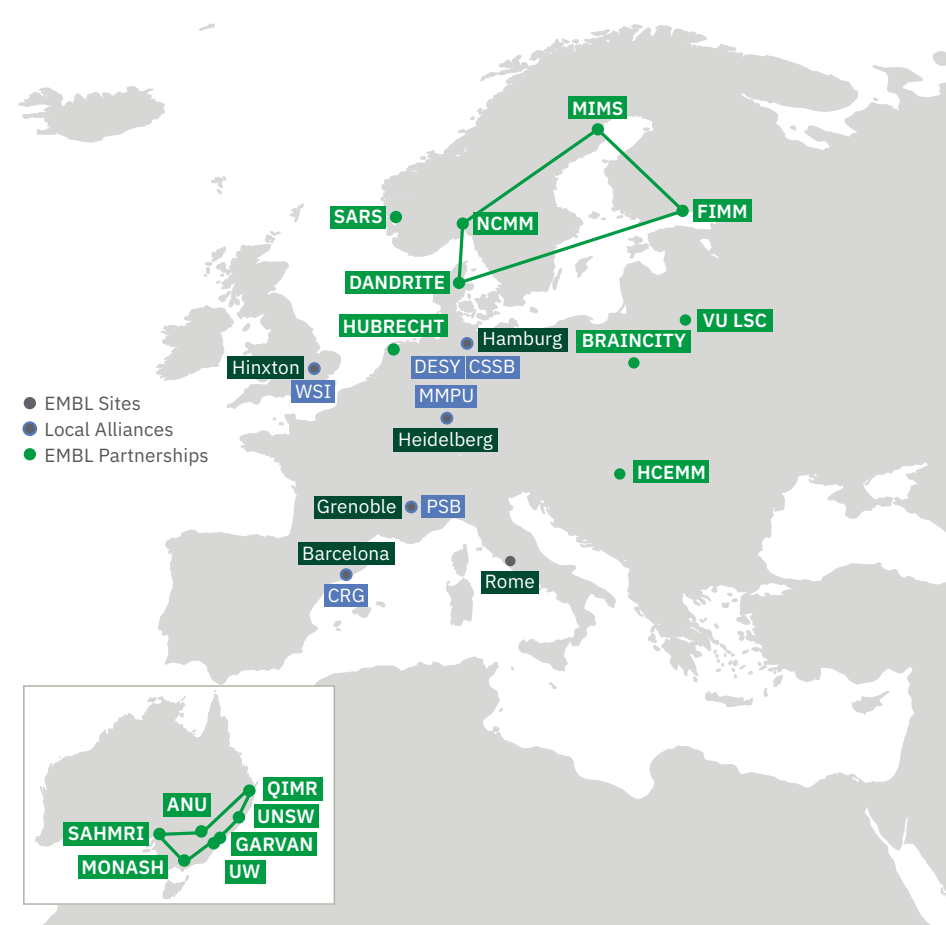
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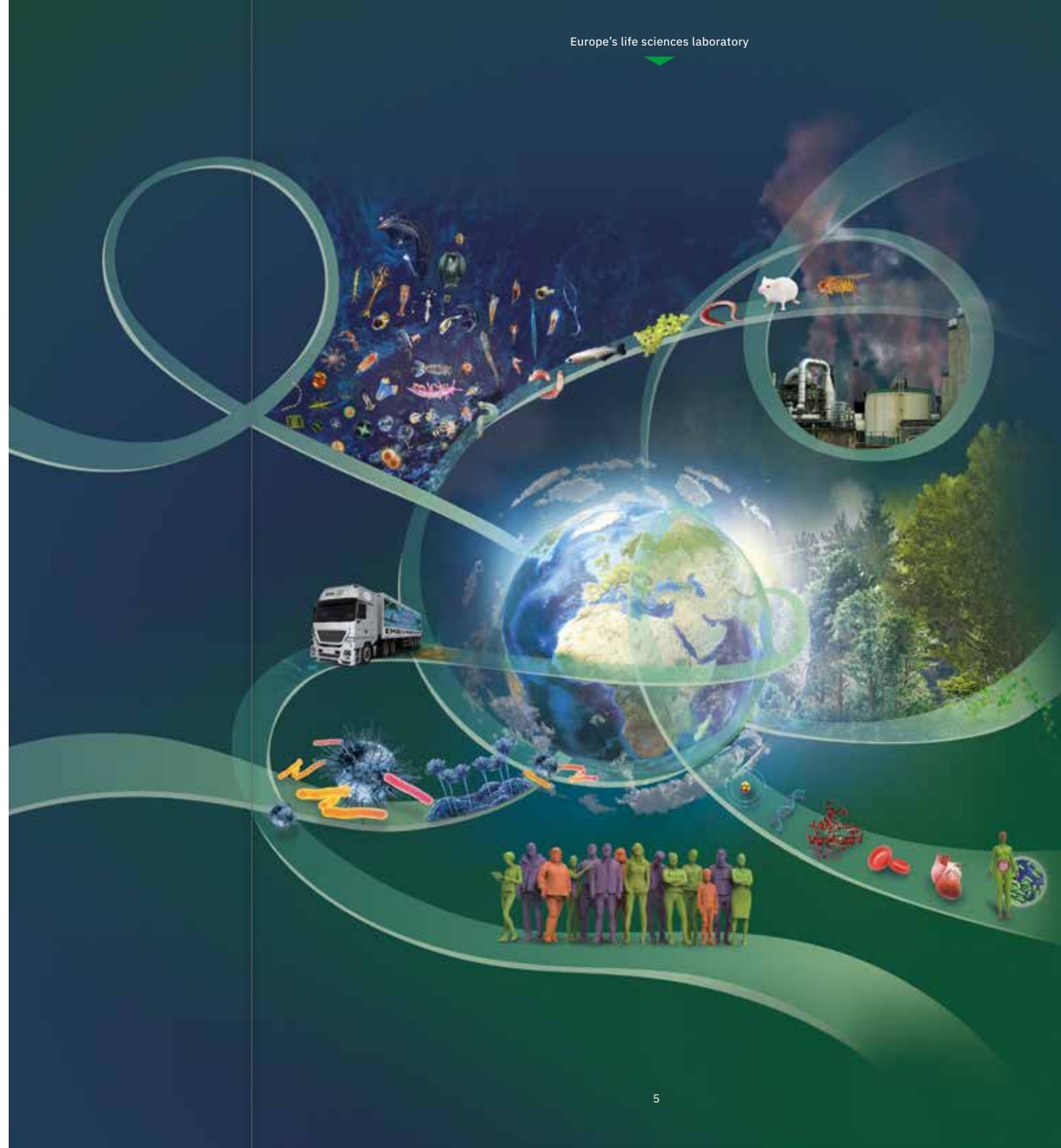
Rome

A new era for molecular biology

EMBL's 2022–2026 scientific programme, *Molecules to Ecosystems*, ushered in a new era of science in Europe, probing the molecular basis of life in context to tackle global challenges, including the emergence of pathogens, loss of biodiversity, spread of antimicrobial resistance, as well as the impact of pollution, climate change, and food insecurity.

EMBL sets the scene for European molecular biology to reach new heights and provide greater impacts in the next five years and beyond. As the first pan-European biology programme for environmental and human health, it sets out a bold scientific vision that is already inspiring collaboration across disciplines and between academia, industry, foundations, and private research organisations.

Created in 1974, EMBL has five missions that encompass research, scientific services, advanced training, innovation and translation, and integrating the life sciences throughout Europe and beyond.



Impactful research

Research at EMBL is collaborative, open, innovative, and multidisciplinary. It emphasises experimental and computational analyses of biological organisation across scales from molecules to ecosystems. Research areas span a range of biological disciplines, including structural biology, genome biology, cell biology, developmental biology, tissue and organ biology, neurobiology, microbiology, bioinformatics and computational biology, and molecular medicine. Building on and traversing across these areas are EMBL's new transversal themes that foster new collaborations within and outside of EMBL. These themes – Planetary Biology, Human Ecosystems, Infection Biology, Microbial Ecosystems, Theory, and Data Sciences – approach the most challenging scientific and societal questions from a collaborative and multidisciplinary perspective to fuel a rich economy of knowledge.



Credit: Yi-Jie Li/EMBL

How molecular biology research could change our approach to pesticides

As a result of EMBL's planetary biology transversal theme, Michael Zimmermann and postdoc Richard Jacoby are two of several EMBL researchers applying molecular biology insights in various ways to better understand pesticide impacts, their degradation, and how to accelerate that degradation. With funding from EMBL's Environmental Research Initiative, this fundamental research can inform approaches to pollution clean-up and potentially guide a new generation of agro-chemicals – chemicals potent enough for the intended objectives, but that quickly degrade and disappear.

“I’m positive about being at EMBL during this current five-year programme where I’m encouraged to think about and pursue molecular approaches to planetary biology issues,” Jacoby said. “Our modern life has come to depend on the chemical industry for necessary pharmaceutical drugs and agricultural production. If we discontinued their use, what would happen to global health? To agricultural production? Hopefully, we can help others have the information they need to build degradable replacements for these chemicals.”



Credit: Kinga Lubowiecka/EMBL

Using light and sound to see deeper into biological tissue

Claire Deo has a rainbow of molecular probes that will play a vital role in developing a hybrid microscope that harnesses light, sound, and adaptive optics to take non-invasive microscope imagery to a new level.

Deo's and Robert Prevedel's research groups are working together on 'deep tissue imaging' technologies. The two combine chemistry and microscopy expertise in this endeavour. Such innovative developments in imaging technology have the potential to be made available to scientists from across Europe through EMBL's state-of-the-art Imaging Centre.

“My group is currently developing molecules that turn on and off in response to stimuli such as light or analytes, to produce fluorescence or photoacoustic signal,” Deo explained. “What drives me is the process of engineering new molecular tools and their applications towards new scientific discoveries. Advancing biology demands robust imaging technology and our efforts in this direction go hand in hand with research in other groups at EMBL, with the goal of establishing new approaches to see deeper into complex tissues.”

Trusted scientific services

EMBL's scientific services enable scientists from EMBL member states and beyond to access the expertise, technology, and data needed to accelerate their science and address global societal challenges. This represents an important financial value for member states. This is particularly true with EMBL's European Bioinformatics Institute (EMBL-EBI) which develops and maintains more than 40 open community databases, tools, and software. EMBL-EBI's data services are among the most comprehensive and integrated in the world and they are open and freely available for everyone to use.

These experimental services span a range of infrastructures and facilities that support academic and industry users throughout Europe and globally. Structural biology and imaging services enable life to be visualised across scales: from atomic snapshots of moving proteins to detailed videos of molecules within cells, tissues, or organisms. Access to this technology and more always comes with guidance and training so users can achieve research goals efficiently and accurately.



Credit: Jeff Dowling, Karen Arnott/EMBL

Enabling greater access to AI protein predictions

Google Deepmind and EMBL-EBI have made AI-powered predictions of more than 200 million 3D protein structures freely and openly available to the scientific community via the AlphaFold Protein Structure Database. The database now includes predicted structures for a wide range of species, including plants, bacteria, animals, and other organisms. AlphaFold has already shown its impact in areas such as improving our ability to fight plastic pollution, gaining insight into Parkinson's disease, increasing the health of honey bees, understanding how ice forms, tackling neglected diseases such as Chagas disease and Leishmaniasis, and exploring human evolution.

EMBL scientists like Sameer Velankar, Team Leader at EMBL-EBI's Protein Data Bank in Europe, were behind making this unparalleled resource so widely accessible.

Commenting on the developers of the AlphaFold algorithm winning the 2024 Nobel Prize for Chemistry, Velankar said, "Since launch, the database has had over one million users from nearly every country. Thousands of scientific papers that mention AlphaFold have already been published. I've never seen anything quite like it."



Credit: Dorota Badowska/EMBL

Expertise to help guide quality assurance in mRNA-based vaccines

BioNTech, which joined Pfizer to develop one of the first messenger RNA vaccines for COVID-19, has been using EMBL Hamburg structural biology services while researching and developing their vaccine platform. One of the EMBL structural biologists involved was Cy Jeffries from the Small-angle X-ray Scattering (SAXS) team.

As Jeffries points out, it takes a powerful tool like SAXS to peer inside the lipid-RNA nanoparticles of an mRNA vaccine. SAXS allows industry researchers to ensure these nanoparticles continue to adhere to the RNA, that the RNA stays fresh, and that it can survive different kinds of storage and even the final push from the syringe into a patient's arm.

"SAXS was indispensable to confirm which nanoparticles work best," Jeffries said. "SAXS is at the forefront of developing new technologies and processes in biomedicine – an invaluable tool available to all scientists, including in industry."

Advanced training for next-generation scientists and science leaders

A proven training ground for scientists at all career levels, EMBL provides world-class theoretical and hands-on education in collaborative, interdisciplinary environments. PhD and postdoctoral fellows are immersed in a rich research environment that nurtures new, creative scientific approaches. In particular, EMBL's EIPOD programme for postdocs instigates and strengthens collaborations with member state institutions. EMBL is also committed to innovative training approaches, leading to new kinds of fellowships, like the ARISE programme, which trains engineers and technology developers to become research infrastructure leaders. Additionally, EMBL's Scientific Visitors Programme allows for shorter EMBL experiences focussed on in-depth knowledge-sharing, with member state scientists embedded in EMBL's collaborative, open scientific environment for up to a year.

EMBL's courses and conferences spotlight diverse scientific leaders to increase research knowhow throughout the whole scientific ecosystem – not just at EMBL. EMBL is also fostering diversity in the researcher pipeline through mentoring opportunities and a career services programme that guides early-career scientists towards paths both in and outside of academia. Additionally, EMBL is committed to sharing its passion for science and knowledge with school children and public audiences alike through its Science Education and Public Engagement (SEPE) activities.



Unique fellowships to develop novel technologies for better science

EMBL's ARISE fellowship programme (Career Accelerator for Research Infrastructure Scientists) provides training for infrastructure scientists who can lead the growing number of core facilities and services in science. Set up to attract a variety of research backgrounds and expertise, ARISE fills a gap in staffing and expertise to run facilities integral to research.

Among the first cohort that started in 2021 is Nicolas Foos, who works in the McCarthy Team at EMBL Grenoble. His fascination for solving 3D structures sparked his interest in the necessary instruments and software, spurring him on to start working at a synchrotron facility.

"After my experience in different places, I became a sort of Swiss army knife, comfortable to work at the lab bench and in service provision," Foos said. "That's why the ARISE fellowship seems like the right fit for me."



Entry points to the science career pipeline

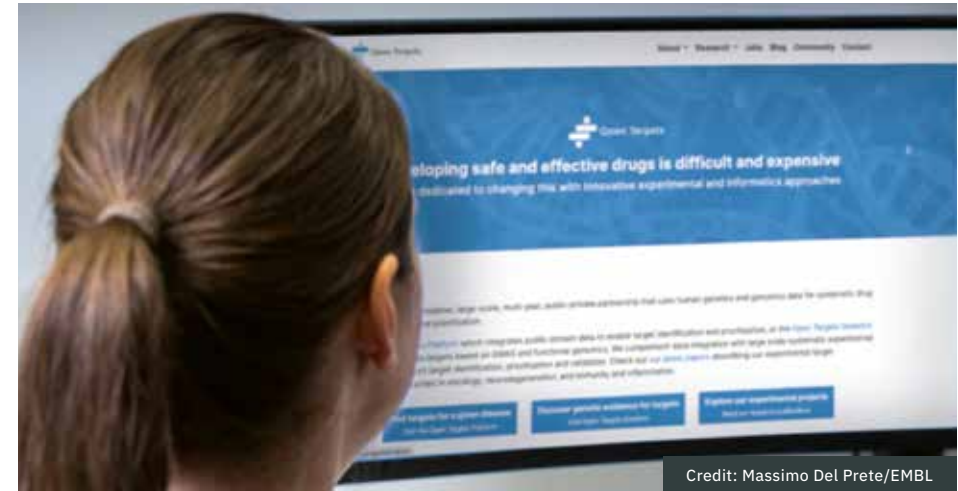
The EMBL *Insight Lecture series* has been inspiring thousands of young learners from across the world since its start in 2003. Each year, a senior EMBL scientist presents their research on a cutting-edge topic in the life sciences in a lecture specifically designed for a secondary school student audience.

Organised by EMBL's Science Education and Public Engagement (SEPE) team, the lecture series allows young learners to attend the hybrid event with their school classes or as individuals. Recordings of the lectures are available on EMBL's website.

The lectures cover a wide range of life sciences topics. "I was immediately hooked!" said one student right after the 2023 lecture with EMBL scientist Detlev Arendt. "The lecture opened a completely new research field for me. The details [of the lecture] gave me insights into current research, which I can not find anywhere else."

Support for tech transfer opportunities

EMBL is inherently a place where the seeds of innovative solutions to real-world problems are sown through fundamental research. Scientists at EMBL frequently develop new technologies and methods to answer biological questions, often in close collaboration with industrial partners. EMBL, with the help of EMBLEM, EMBL's technology transfer arm, is committed to transforming cutting-edge research into impactful applications. To achieve this, EMBL employs a range of technology transfer instruments, such as open innovation collaborations, public-private partnerships, knowledge-exchange programmes, industry-sponsored research collaborations, and the creation of spin-offs.



Credit: Massimo Del Prete/EMBL

Innovation seeding a path for more efficient drug development

Identifying drug targets is a complex yet crucial process in the life sciences. Open Targets is an innovative partnership between academia and the private sector that aims to systematically identify and prioritise drug targets. The vision is to help develop safe, effective medicines for human disease with a focus on immunology, cancer, and neurodegeneration. Open Targets publishes novel experimental data and informatics analyses, and has open source informatics resources that provide integrated data and tools for the broader scientific community to help explore therapeutic hypotheses.

Ellie McDonagh is the Informatics Science Director of Open Targets. She oversees the informatics research programme, which integrates relevant data on drug targets.

“Open Targets is in a unique position: we bring together academic researchers at the cutting edge of scientific discovery and data knowledge services, pharmaceutical target discovery scientists and computational biologists, and a core team with critical statistical analysis and informatics expertise,” said McDonagh. “Through the consortium, we work together to support target identification and prioritisation, with the ultimate goal of making safer and more effective treatments for disease.”

Science leadership in Europe and worldwide

EMBL has 29 member states and collaboration is a vital principle of EMBL's activities. EMBL works to establish links and initiate joint projects between and among scientists in Europe and beyond. Collaborative research, shared infrastructures, as well as open science and knowledge sharing between the member states and other international partners are important investments EMBL makes for the future. EMBL also fosters this international collaboration between scientific communities in Europe and around the world by playing a role in advising international and national actors on scientific strategy and policy to make the voice of life sciences heard on the international arena. The result is a network of stakeholders who deliver more cohesive research with scientific, societal, and political benefits for partners globally.



Collaboration with European partners on coastal ecosystem exploration

The TREC expedition (Traversing European Coastlines) is EMBL's flagship project to study life in its natural context. TREC brings molecular and cellular biology together with environmental research to further scientific knowledge and address urgent planetary and societal challenges. The highly collaborative EMBL-led project is only possible due to the joint efforts of numerous European partner organisations, such as Tara Ocean Foundation, the European Marine Biological Resource Centre, Ifremer, CNRS, Stazione Zoologica Anton Dohrn, and more than 50 other institutions from Europe and beyond.

From April 2023 to July 2024, TREC researchers gathered biological, environmental, and biogeochemical data along the European coastlines at 115 land-sea transects. This transnational expedition crosses borders and disciplines to combine ocean exploration with parallel sampling of soil, sediment, shallow water, and selected model organisms in various habitats. TREC researchers as well as member state scientists who are part of 'plug-in projects' are supported by EMBL's land-based mobile services and local marine research institutions. Eventually, all collected data will be made freely and openly available by EMBL-EBI data resources.

"Given the scale and urgency of human and planetary health challenges, it is important for EMBL to organise this large pan-European, highly collaborative and cross-disciplinary project," said Paola Bertucci, Head of EMBL Scientific Expeditions. "EMBL is well positioned to lead this because of its intergovernmental status and large network of collaborators and partners."



‘Twinning’ and winning via European scientific collaboration

It’s the best of all symbiotic relationships when EMBL and its partners collaborate on science. In this case, thanks to Horizon 2020 Twinning Widening Action funding, EMBL has several partners in its member states working collectively on a project known as SymbNET, which advances host-microbiome symbiosis research.

EMBL partnered with the Portuguese Instituto Gulbenkian de Ciência (IGC), University of Kiel (Germany), University of Lausanne (Switzerland), and ITQB NOVA Lisbon (Portugal) on this research endeavour, which enables Portuguese researchers to expand their research and training capacities in microbiota research, forming a powerful European network of excellence in this field. Under Horizon 2020, EMBL secured funding for five Twinning projects with partners from nine countries, resulting in research hubs throughout Europe underpinned by sustainable funding. In 2024, EMBL was awarded funding for two more Twinning projects from the Horizon Europe programme, with collaborations expanded to three new countries.

As in any good cooperative relationship, everyone benefits. And the collaboration with IGC has only grown further as the two institutes are aspiring to establish a more formal partnership focusing on the topic of One Health. This will epitomise EMBL’s vision of contributing to Europe’s ecosystem of scientific excellence by sharing EMBL’s networks, infrastructure, and expertise – especially in the context of EMBL’s 2022–2026 Programme, ‘Molecules to Ecosystems’.

“EMBL is a hub for collaboration and creativity,” said Plamena Markova, EMBL’s Head of International Relations. “Our own knowledge and talent are nurtured as well when we create partnerships and help countries establish EMBL-like institutes. We work very closely with our member states to capitalise on their national scientific strengths and build transformative joint initiatives with impacts on both science and society.”



People, processes, and places

EMBL is continuously looking at ways to improve the way research is done. Consequently, administrative and operational teams help move the organisation forward in areas like sustainability; equality, diversity, and inclusion; open science; and research assessment.

EMBL's staff-led **Sustainability Strategy** has provided ways to significantly reduce environmental impacts by 2030 with goals of reducing energy consumption, use of plastics in labs, and work-related travel. EMBL's **Equality, Diversity, and Inclusion Strategy** aims to create a more inclusive research and work culture that leverages diversity in its broadest sense. EMBL's **Open Science Policy** provides for databases and software to be made freely available wherever possible and encourages open access publication. And because EMBL recognises the value of a broad range of scientific outputs and the need to assess them based on their intrinsic merit, it has adopted the principles of the **San Francisco Declaration on Research Assessment (DORA)**.

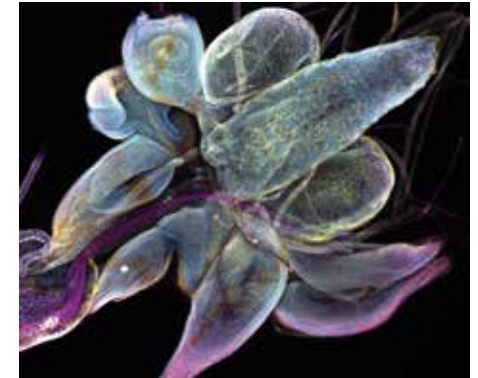
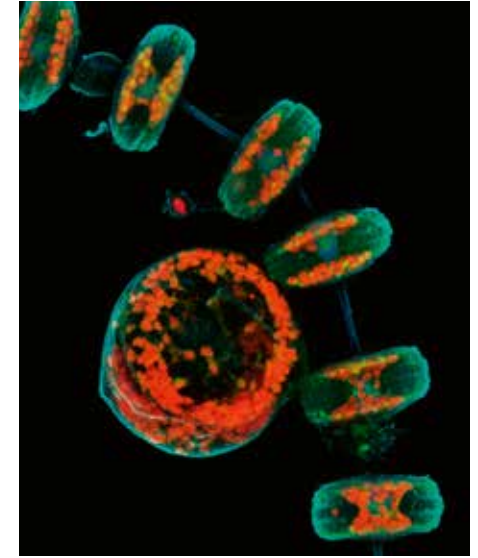
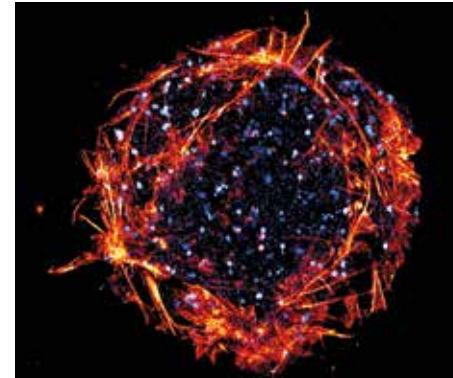
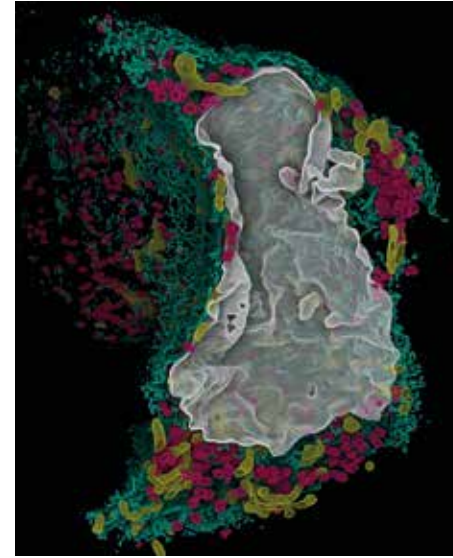
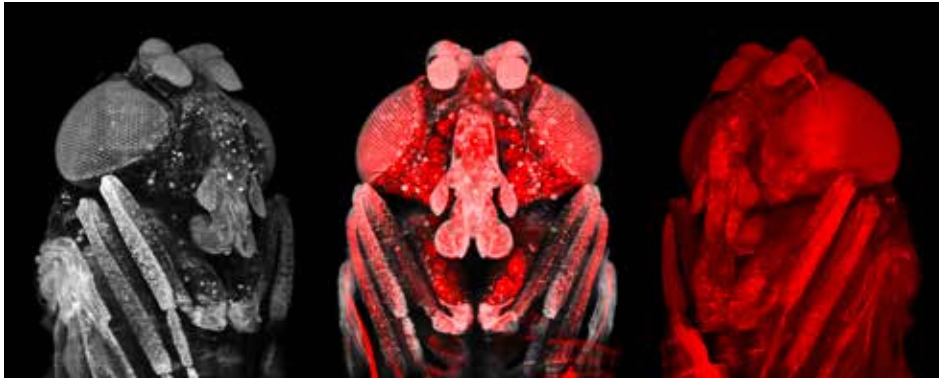
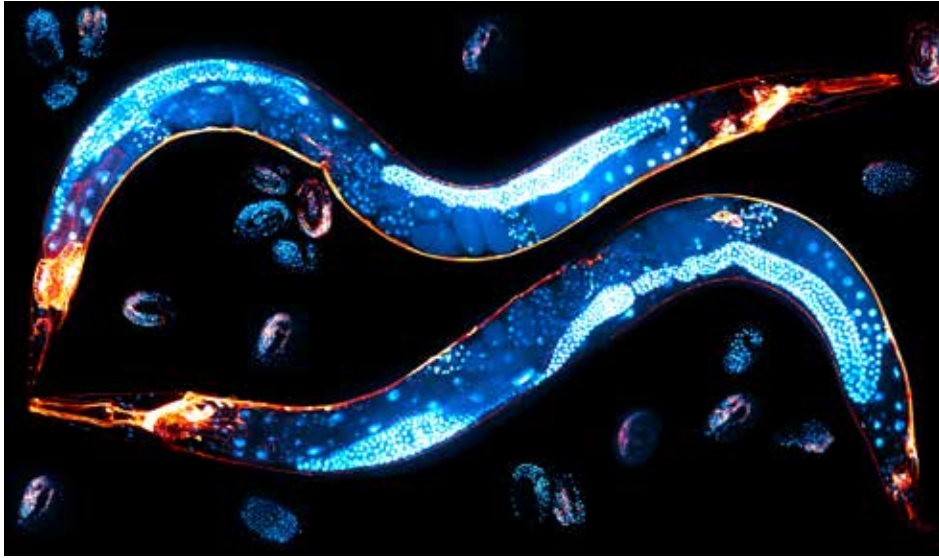


Credit: Stuart Ingham/EMBL

The road to more sustainable science

Over the past few years, EMBL has worked hard to lay the groundwork to become a sustainable organisation. In 2021, EMBL launched its first Sustainability Strategy, and since then, Brendan Rouse, Head of Sustainability and Marta Rodríguez-Martínez, Sustainability Officer, have been interacting with multiple departments and teams across EMBL to develop the necessary plans to achieve EMBL's sustainability objectives, including building a strong sustainability culture.

“We are very excited about the progress EMBL has made in becoming a more sustainable organisation. One illustration of this is our involvement with a sustainability programme, designed specifically for labs – Laboratory Efficiency Assessment Framework (LEAF),” Rodríguez-Martínez said. “LEAF was developed as an online guide and self-assessment tool to encourage lab groups to become more sustainable. We have worked with all of our wet research and service labs and all have joined the scheme. By adopting sustainable research practices, the participating groups will reduce their costs, operate more efficiently, and decrease their environmental impact.”



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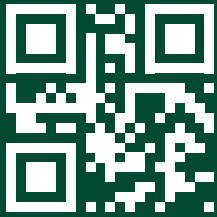
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Particle flow tracked over time in 3D human microvessels grown *in vitro*.
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