Facing the challenge

Synapse The impact of COVID-19 on women in science
Nucleus Tackling tropical diseases
Cultures EMBL's future directions
Contents

Nucleus

Feature stories

18 Understanding the impact of mass extinction
EMBL invites experts and activists to discuss the effects of biodiversity loss and how scientists and wider society can respond

22 Tackling tropical diseases
Members of the EMBL community are working to improve our understanding of malaria and sleeping sickness

26 Seeing deeper inside cells
EMBL scientists are probing the smallest parts of cells for answers to the biggest challenges

Synapse

News stories

5 Flexible and protected
6 Exploring indirect impacts of COVID-19
7 A synthetic mini-antibody to combat COVID-19
8 Funding to predict the risk of infectious disease outbreaks
8 A precise new tool for cancer research
9 An organoid cell atlas to enhance biomedical research
9 Genome sequencing accelerates cancer detection
9 Artificial intelligence finds patterns of mutations and survival
10 Fighting cardiovascular disease with acne drug
10 New clues to a 500-year-old mystery about the human heart
11 How deadly parasites glide into human cells
11 Upgraded beamlines at EMBL Grenoble unveiled
12 Intelligent software tackles plant cell jigsaw
12 Achieving personalised therapeutics
13 Launch of ELLIS Heidelberg
13 Predicting how gene expression varies
14 Eat more to grow more arms... if you’re a sea anemone
14 Human and mouse cells run at different speeds
15 New partnership in Lithuania
15 The Nordic EMBL Partnership: supporting national research
16 New fellowships to boost infrastructure

Cultures

EMBL community stories

32 EMBL Fellows’ Career Service celebrates first birthday
34 Arrivederci Phil!
36 Awards & honours

Alumni

37 Building communities in challenging times
37 In memory...
38 A vision of the future
40 Boosting the life sciences through alumni networks
41 New perspectives
42 Working for a healthier world
43 Facing challenges together
For all of us, this has been a year of unexpected challenges. The coronavirus pandemic has significantly changed our daily lives, compelling us to find new ways to stay in contact and support one another from a distance. At EMBL, the response to the pandemic has continued, including the identification of a mini-antibody that shows potential as a future treatment for COVID-19 (p. 7).

EMBL’s training teams – both internal (p. 32) and external – have faced the challenge of rapidly moving their training offerings online. This has opened up EMBL courses and conferences to larger and more diverse audiences, including many people who would not have been able to attend training on site. In this issue, we report on a conference examining the impact of COVID-19 on women in science (p. 6), and share insights from EMBL's annual Science and Society Conference (p. 18).

COVID-19 is only one of many challenges to human health being tackled at EMBL. Members of the EMBL community are carrying out research on the parasites that cause malaria and sleeping sickness (p. 22), while scientists from EMBL and Stanford have found that a drug used for treating acne might work as a treatment for other infectious diseases, including those that cause malaria and sleeping sickness (p. 22).

There’s no doubt that the winter will bring additional challenges in our fight against COVID-19, and the pre-existing challenges – including other infectious diseases, climate change, and loss of biodiversity – have not gone away. At such times, the value of scientific discovery is made clearer to us than ever. It is only by pursuing insights from EMBL’s annual Science and Society Conference (p. 18).

We also report on technological challenges, as members of EMBL’s Mahamid group tell us about their work to develop cryo-electron tomography: an imaging technique that can show the structures of molecules inside cells (p. 26). This same technique has helped to reveal the structure of SARS-CoV-2’s spike protein, providing details that can show the structures of molecules inside cells (p. 26). The team analysed the molecular interactions of the globular portion of the spike protein, with its coat of protective glycan chains (cyan). The team’s results were surprising: the data showed that the globular portion of the spike protein, which contains the receptor-binding region and the machinery required for fusion with the target cell, is connected to a flexible stalk. “The upper spherical part of the spike has a structure that is well reproduced by recombinant proteins used for vaccine development,” explains Martin Beck, EMBL group leader and a director of the MPI of Biophysics. “However, our findings about the stalk, which fixes the globular part of the spike protein to the virus surface, were new.”

The stalk was expected to be quite rigid,” adds Gerhard Hummer, leader and a director of the MPI of Biophysics. “But in our computer models and in the actual images, we discovered that the stalks are extremely flexible.” By combining molecular dynamics simulations and cryo-electron tomography, the team identified three joints that give the stalks their flexibility. “Like a balloon on a string, the spikes appear to move on the surface of the virus and thus are able to search for the receptor for docking to the target cell,” explains Jasmijn Krijnse Locker, group leader at the Paul-Ehrlich-Institut. “To prevent infection, these spikes are targeted by antibodies. However, the images and models also showed that the entire spike protein, including the stalk, is covered with chains of glycans – sugar-like molecules. These chains provide a kind of protective coat that hides the spikes from neutralising antibodies: another important finding on the way to effective vaccines and medicines.

“The stalk was expected to be quite rigid,” adds Gerhard Hummer, leader and a director of the MPI of Biophysics. “But in our computer models and in the actual images, we discovered that the stalks are extremely flexible.” By combining molecular dynamics simulations and cryo-electron tomography, the team identified three joints that give the stalks their flexibility. “Like a balloon on a string, the spikes appear to move on the surface of the virus and thus are able to search for the receptor for docking to the target cell,” explains Jasmijn Krijnse Locker, group leader at the Paul-Ehrlich-Institut. “To prevent infection, these spikes are targeted by antibodies. However, the images and models also showed that the entire spike protein, including the stalk, is covered with chains of glycans – sugar-like molecules. These chains provide a kind of protective coat that hides the spikes from neutralising antibodies: another important finding on the way to effective vaccines and medicines.

*BY MATHIAS JÄGER*

At the start of a COVID-19 infection, the coronavirus SARS-CoV-2 docks onto human cells using the spike-like proteins on its surface. The spike protein is at the centre of vaccine development because it triggers an immune response in humans. A group of scientists in Germany, including members of EMBL Heidelberg, the Max Planck Institute (MPI) of Biophysics, the Paul-Ehrlich-Institut, and Goethe University Frankfurt, have focused on the upper spherical part of the spike protein to gain insights they can use for vaccine development, “The upper spherical part of the spike has a structure that is well reproduced by recombinant proteins used for vaccine development,” explains Martin Beck, EMBL group leader and a director of the MPI of Biophysics. “However, our findings about the stalk, which fixes the globular part of the spike protein to the virus surface, were new.”

“The stalk was expected to be quite rigid,” adds Gerhard Hummer, leader and a director of the MPI of Biophysics. “But in our computer models and in the actual images, we discovered that the stalks are extremely flexible.” By combining molecular dynamics simulations and cryo-electron tomography, the team identified three joints that give the stalks their flexibility. “Like a balloon on a string, the spikes appear to move on the surface of the virus and thus are able to search for the receptor for docking to the target cell,” explains Jasmijn Krijnse Locker, group leader at the Paul-Ehrlich-Institut. “To prevent infection, these spikes are targeted by antibodies. However, the images and models also showed that the entire spike protein, including the stalk, is covered with chains of glycans – sugar-like molecules. These chains provide a kind of protective coat that hides the spikes from neutralising antibodies: another important finding on the way to effective vaccines and medicines.

*ABOVE* Model of the spike protein, with its coat of protective glycan chains (cyan).
A synthetic mini-antibody to combat COVID-19

Scientists screen hundreds of synthetic mini-antibodies, identifying one that might stop SARS-CoV-2 from infecting human cells.

By Dorota Badowska

Nanobodies, small antibodies found in camels and llamas, are promising as tools against viruses due to their high stability and small size. Technological advances now allow for rapid selection of synthetic nanobodies, called sybodies.

EMBL Hamburg’s Low group searched through existing sybody libraries to find sybodies that could block SARS-CoV-2 from infecting human cells. They tested the selected sybodies, with one called sybody 23 turning out to be particularly effective.

To test if sybody 23 could neutralise a virus, a different virus – called a lentivirus – was modified such that it carried SARS-CoV-2’s spike protein on its surface. Sybody 23 successfully disabled the modified virus in vitro.

The results of this project hold out the promise of a potential way to treat COVID-19. In future work, the scientists will perform further analyses to confirm whether sybody 23 could be an effective COVID-19 treatment.

The project was led by EMBL Hamburg, together with collaborators from the Centre for Structural Systems Biology (CSSB) in Hamburg, and Karolinska Institutet, Sweden.

Funding to predict the risk of infectious disease outbreaks

Better surveillance and prediction tools are needed to identify outbreaks earlier and anticipate their impact.

By Guy Crichton

The Versatile Emerging infectious disease Observatory (VEO) project is a consortium of 20 research partners including EMBL’s European Bioinformatics Institute (EMBL-EBI), which aims to develop a smart detection system for infectious disease outbreaks. The researchers will use laboratory research, field studies, and big data research to monitor and analyse various sources of information. VEO has recently received €15 million in funding from the European Commission’s Horizon 2020 Programme to start its research.

By linking and analysing various sources of information, the scientists involved in the project hope to identify and classify the risk of disease outbreaks earlier. This will also allow researchers to generate clear information about the potential impact of the outbreak faster, and to develop a warning system.

"The VEO consortium builds on the work of the COMPARE project, a multicdisciplinary research network that aims to bring together relevant data to help identify, contain, and mitigate emerging infectious disease and foodborne outbreaks," explains EMBL-EBI group leader Guy Crichton. "By exploring the most likely scenarios, we are preparing ourselves for potential future outbreaks."
Artificial intelligence finds patterns of mutations and survival

AI applied to tumour microscopy images detects patterns of 167 different mutations and predicts patient survival in 28 cancer types

BY MEHDI KHADRAOUI

Researchers at EMBL’s European Bioinformatics Institute (EMBL-EBI) and collaborators have developed an artificial intelligence (AI) algorithm that uses computer vision to analyse tissue samples from cancer patients. The algorithm can distinguish between healthy and cancerous tissues, and can also identify patterns of more than 160 DNA and thousands of RNA changes in tumours. The study highlights the potential of AI for improving cancer diagnosis, prognosis, and treatment.

“Clinicians use microscopy slides for cancer diagnosis all the time. However, the full potential of these slides hasn’t been unlocked yet. As computer vision advances, we can analyse digital images of these slides to understand what happens at a molecular level,” says Yu Fu, a postdoc in EMBL-EBI’s Gerstung group.

Computer vision algorithms are a form of AI that can recognise certain features in images. Fu and colleagues repurposed such an algorithm to distinguish various cancer types from healthy tissue. They showed that this algorithm can also be used to predict survival and even patterns of DNA and RNA changes from images of tumour tissue.

Fu, Y et al. Nature Cancer, 27 July 2020. DOI: 10.1038/s43018-020-0085-8

An organoid cell atlas to enhance biomedical research

EMBL-EBI is one of eight partners in the new EU-funded HCA|Organoid consortium

BY GANA SITHOE

Organoids are groups of cells grown in laboratories. They can be useful tools for biomedical research, but they are resolutely new and there are many unanswered questions about how they work.

To address some of these questions, researchers are planning to create a specialised Organoid Cell Atlas, which will foster the production, quality control, dissemination, and utilisation of single-cell data for human organoids. By creating well-characterised in vitro models of human organs, this resource could enable translational research on rare genetic diseases, complex multifactorial diseases, and cancer.

The HCA|Organoid project is one of six pilot actions funded by the EU Horizon 2020 Framework Programme, which will be European contributions to the Human Cell Atlas (HCA) project. HCA is an ambitious global initiative striving to advance biomedical research and therapy using single-cell technologies. The HCA|Organoid consortium comprises eight partners, including EMBL’s European Bioinformatics Institute, and will receive €5 million in EU funding.


Genome sequencing accelerates cancer detection

Researchers have developed a statistical model that uses genomic data to predict the risk of developing cancer of the oesophagus

BY GANA SITHOE

Oesophageal cancer often develops from a condition called Barrett’s oesophagus. Existing monitoring and treatment methods are very intrusive, with patients often undergoing burdensome procedures to ensure no cancer is missed.

Researchers have now developed a statistical model that uses genomic data to accurately predict whether a patient with Barrett’s oesophagus has a high or low risk of developing cancer.

Researchers at EMBL’s European Bioinformatics Institute (EMBL-EBI), the University of Cambridge, and collaborators sequenced genomes from biopsies collected from patients with Barrett’s oesophagus. The researchers used the data to look for differences between patients who were ultimately diagnosed with cancer and those who were not. The data were used to develop a statistical model measuring each patient’s individual risk.

This approach allows patients at greatest risk to be treated immediately, rather than conducting repeated biopsies until early signs of cancer are found. Patients with low risk and stable disease can be monitored less frequently. Overall, the authors estimate that monitoring can be reduced for 50% of patients with Barrett’s oesophagus.

Killcoyne, S, Gregson, E et al. Nature Medicine, 7 September 2020. DOI: 10.1038/s41591-020-1023-y

A precise new tool for cancer research

‘Mini organs’ help to clarify how cells turn cancerous, potentially shedding light on ways to stop tumour growth

BY IVY KUPEC

Scientists in EMBL’s Jechlinger group have created a new, realistic 3D testbed to help them study cancer cells as they first form.

This could potentially allow interventions to stop tumour development.

By creating ‘mini organs’, or organoids, from healthy mouse breast tissue and employing laser light-sheet technology to steadily monitor cell growth, researchers were able to track, study, and even determine a tipping point when cells that express oncogenes (cancer-causing genes) turn cancerous. ‘The hope is that this work could lead to new strategies for approaching breast cancer treatment.’

“We’ve now created a robust platform to explore cell deficiencies and a way to realistically study response to treatments at the cellular level,” says EMBL group leader Martin Jechlinger. “If we know about deficiencies already tested in these systems, we can potentially more accurately flag risk groups for better medical care, in much the same way that identifying genes like BRCA1 and BRCA2 – which are found mutated in breast cancer – has informed medical decisions. Where this could potentially lead is quite exciting.”

Alladin, A, Chebbi, L et al. eLife, 21 July 2020. DOI: 10.7554/elife.54066

Tumour cells (green) among normal cells (grey) grow and encroach on the organoid structure, as shown in the progression in these snapshots. In the lower panel, it’s possible to identify new cells that arise from a single cell of the same colour.
Fighting cardiovascular disease with acne drug

Researchers from EMBL Heidelberg and Stanford University show that a drug already used to treat acne is a potential treatment for a leading cause of heart failure.

BY MATHIAS JÄGER

Dilated cardiomyopathy (DCM) affects 1 in 250 people, and is a leading cause of heart failure. Researchers at EMBL and Stanford University studied a single family with inherited DCM to understand the cause of their disease. By looking at differences in the genomes of patient-derived cells and genome-edited cells to demonstrate in vitro that this was the pathogenic mutation, they then searched for compounds that might work as treatment options, using the open databases at EMBL's European Bioinformatics Institute (EMBL-EBI).

The team identified a chemical called all-trans retinoic acid (ATRA) as a potential treatment. ATRA is a drug used for the treatment of acne and a type of leukaemia called acute promyelocytic leukaemia.

“This is a promising result in approaching RBM20-deficient DCM,” says EMBL and Stanford scientist Lars Steenmetz. "In addition, the general approach and the strategy we used in this study could work for a number of other dominant diseases.”


New insights into the gliding movements by which the parasites cause malaria and toxoplasmosis invade human cells

The gliding motion relies on the proteins actin and myosin. In Apicomplexa, myosin interacts with several other proteins, which together form a complex called the glideosome. Understanding the exact mechanism by which the glideosome works could aid the development of drugs to prevent its assembly, stopping disease progression.

BY DOROTA BADOWSKA

In biological terms, gliding refers to the type of motion in which a cell moves along a surface without changing its shape. This form of movement is unique to parasites from the phylum Apicomplexa, such as Plasmodium, which causes malaria, and Toxoplasma, which causes toxoplasmosis.

The advantage of targeting Plasmodium at that stage is that only about a hundred parasites are present. Understanding the parasite’s gliding motility might help to develop drugs or vaccines that target Plasmodium before it multiplies.

Samuel Pazicky, S et al. Communications Biology, 13 October 2020, DOI: 10.1038/s42003-020-01283-8

(Above) A model of the Plasmodium essential light chain protein.

New clues to a 500-year-old mystery about the human heart

Scientists show that muscular structures first described by Leonardo da Vinci are essential for heart function.

BY MEHDI KHADRAOI

A group of researchers, including scientists from EMBL's European Bioinformatics Institute (EMBL-EBI), have investigated the function of a complex mesh of muscle fibres that line the inner surface of the heart. Their study shows how the shape of these muscles impacts heart performance and heart failure.

In early development, the heart grows an intricate network of muscle fibres called trabeculae, which form geometric patterns on its inner surface. These are thought to help oxygenate the developing heart, but their function in adults has remained unknown since the 16th century, when Leonardo da Vinci first sketched trabeculae and their snowflake-like fractal patterns.

The researchers used artificial intelligence to analyse 25,000 MRI scans, along with associated heart morphology and genetic data. They discovered that the shape of trabeculae affects the performance of the heart. To confirm this, they analysed genetic data from 50,000 patients and found that different fractal patterns in these muscle fibres affected the risk of developing heart failure.

Further research on trabeculae may help scientists better understand how heart diseases develop and explore new approaches to treatment.


Upgraded beamlines at EMBL Grenoble unveiled

The beamlines run jointly by EMBL Grenoble and the ESRF have re-opened, with significant upgrades that exploit the brand new fourth-generation ESRF synchrotron source.

BY MYLÈNE ANDRÉ

Almost two years ago, the European Synchrotron Radiation Facility (ESRF) was shut down for 20 months, during which time the synchrotron ring was completely rebuilt and upgraded into the world’s first Extremely Brilliant Source (EBS) — a €150 million project that runs from 2017 to 2022. The innovations brought about by the EBS project have now been unveiled to the scientific community. Apart from the construction of a new storage ring, they include an advanced instrumentation upgrade programme and improvement of all the ESRF’s structural biology beamlines, notably a significant upgrade of MASSIF-1. This is one of the seven beamlines run jointly by the ESRF and EMBL Grenoble, and was the world’s first automated beamline.

In its new form, MASSIF-1 will be operated in coordination with the EMBL XTX Lab, which will bring a new level of efficiency, particularly in intensive fragment screening campaigns for drug discovery. The new developments will maintain EMBL and ESRF at the forefront of innovations in macro-molecular crystallography beamline technology for the benefit of structural biology.
PlantSeg complements microscopy methods to reveal how plant tissues develop

BY IVY KUPEC

An EMBL research group led by Anna Kreshuk has joined a consortium of plant biologists and computer scientists to develop a tool that enables them to sort through cells to study morphogenesis: the origins of the structures in an organism and the way it develops.

To study morphogenesis of tissues at the cellular level, researchers need to image individual cells. They have to separate or ‘segment’ them to see each cell individually and analyse the changes over time. The team designed a tool called PlantSeg to carry out this segmentation process, providing the most accurate and versatile analysis of plant tissue development to date.

PlantSeg is an independent tool, but one that Kreshuk’s team will eventually merge into another tool her lab is working on, ilastik Multicut workflow.

Wolny, A, Cerrone, L et al. elife, 29 July 2020. DOI: 10.7554/eLife.57613

PlantSeg is an independent tool, but one that Kreshuk’s team will eventually merge into another tool her lab is working on, ilastik Multicut workflow.

Wolny, A, Cerrone, L et al. elife, 29 July 2020. DOI: 10.7554/eLife.57613

Microscopy provides imagery to the algorithm, which then delineates the cellular structures, making the segmentation clearer.

Machine learning-based algorithms, like the ones at the core of PlantSeg, are trained from correct segmentation examples. The group has trained PlantSeg on many plant tissue volumes, so that it generalises quite well to unseen plant data. The underlying method is, however, applicable to any tissue and could easily be retrained for animal tissue.

PlantSeg is an independent tool, but one that Kreshuk’s team will eventually merge into another tool her lab is working on, ilastik Multicut workflow.

Wolny, A, Cerrone, L et al. elife, 29 July 2020. DOI: 10.7554/eLife.57613

Predicting how gene expression varies

Discoveries at EMBL will help researchers to interpret one of the most common types of experiments in genomics and medical studies

BY FABIAN OSWALD

By studying the genomes of fruit flies, scientists from the Zaugg and Purlong groups at EMBL Heidelberg have identified a set of genomic features that can predict how much the expression of a gene varies between individuals in a species.

The scientists examined 75 embryos of the fruit fly Drosophila, using a machine learning approach to identify the features that are fundamental to gene expression variation. They found a set of around 100 genetic features that made the expression of some genes especially robust, allowing them to maintain their normal function while the organism reacts to environmental change. Knowing these features now makes it possible to predict whether a gene will show high or low expression variation.

These findings will help scientists to interpret one of the most common types of experiments in the genomics and medical community, known as differential expression experiments. These experiments are used to compare gene expression levels between two groups, for example patients receiving treatment and a control group. Scientists can now identify which genes are variable by nature for a particular medical treatment.

Sigalova, OM et al. Molecular Systems Biology, 7 August 2020. DOI: 10.15252/msb.20209539

Achieving personalised therapeutics

EMBL is part of a growing movement to achieve cell-based medicine in Europe

BY IVY KUPEC

The LifeTime Initiative, which includes EMBL Heidelberg and EMBL’s European Bioinformatics Institute (EMBL-EBI), has developed the LifeTime Strategic Research Agenda to integrate breakthrough technologies to further develop personalised treatments for five major classes of disease: cancer, cardiovascular and metabolic disorders, chronic inflammation, infectious diseases, and neurological disorders.

LifeTime is a consortium of more than 90 leading European research institutions, together with international advisers and over 80 supporting companies.

Scientists – and ultimately healthcare providers – can now understand molecular details and changes responsible for driving the onset and progression of diseases or the emergence of therapy resistance in each patient. Single-cell and imaging technologies allow scientists to observe and analyse cells individually and understand how cells ‘make decisions’.

This roadmap explains how technology can be rapidly co-developed and transitioned into clinical settings to address key medical challenges. This requires close interactions between research institutions, hospitals, industry, and European infrastructures to deploy and analyse medical big data across European borders.


Launch of ELLIS Heidelberg

A newly established research unit will support artificial intelligence and machine learning in the life sciences

BY MATHIAS JAGER

A newly founded research unit of the European Laboratory for Learning and Intelligent Systems (ELLIS) will bring together the best artificial intelligence (AI) researchers in Heidelberg to increase the level of cooperation between participating institutes, ensuring that AI research in Heidelberg can have international impact.

ELLIS is a pan-European network of leading researchers in the field of artificial intelligence, currently comprising 28 units in 14 countries. The new ELLIS unit brings together scientists from three leading Heidelberg research institutes: EMBL Heidelberg, Heidelberg University, and the German Cancer Research Center (DKFZ).

The newly established unit will increase the international visibility of AI research groups in Heidelberg, and will make it easier to hire talented people in this very competitive field.

The unit has already planned not only its research activities but also an interdisciplinary training programme for young scientists.

This new initiative is open for joint projects with industry and is supported by an existing network of industry partners.
EAT MORE TO GROW MORE ARMS… IF YOU’RE A SEA ANEMONE

A group led by scientists from EMBL has discovered that the number of tentacles a sea anemone grows depends on the amount of food it eats.

BY MATHIAS JÄGER

Your genetic code determines that you will grow two arms and two legs. Sea anemones, however, defy this rule and have a variable number of tentacle arms. Until now, it’s been unclear what regulates the number of tentacles a sea anemone can grow. Scientists from the Ikmi group at EMBL, Heidelberg and collaborators have shown that the number of tentacles is defined by the amount of food consumed.

The scientists found that muscle cells pre-mark the sites of new tentacles. These muscle cells change their gene expression signature in response to food. While this finding is novel on its own, it also shows that sea anemones, which are traditionally used for evolutionary developmental studies, are well-suited to study morphogenesis in the context of organism–environment interactions.

This sequence shows the development process of a sea anemone’s tentacles. Knowing that the number of tentacles in sea anemones is determined by their food intake, the group plans to define the key nutrients critical to this process. They also want to further investigate the unconventional role of muscles in defining the sites where new tentacles form.

Ikmi, A et al. Nature Communications, 2 September 2020. DOI: 10.1038/s41467-020-18133-0

Human and mouse cells run at different speeds

EMBL scientists uncover the biochemical mechanisms that govern the tempo of embryo development.

BY LUCA TANCREDI BARONE

In the early phase of vertebrate development, the embryo develops into a series of segments. This process is governed by an oscillating biochemical process, known as the segmentation clock. In mice, each oscillation of this clock takes about two hours, while in human cells it takes five hours. Why the length of this cycle varies between species has remained a mystery.

A team including scientists from EMBL Barcelona suspected that the difference might be due to a master gene called HES7. They performed a number of experiments in which they swapped the HES7 genes between human cells and mouse cells, but to their surprise this did not affect the cycle.

The team then looked at the degradation rate of the HES7 protein, observing that both the human and the mouse version of HES7 were degraded more slowly in human cells than in mouse cells. They also discovered that the time it took cells to transcribe the HES7 gene into messenger RNA (mRNA), to process the mRNA molecule, and to translate it into proteins was significantly different. This showed that it’s the cellular environment in human and mouse cells that makes the difference in the timescales involved.

Matuda, M et al. Science, 18 September 2020. DOI: 10.1126/science.abb5688

New agreement establishes the VU LSC–EMBL Partnership for Genome Editing Technologies

Soon after Lithuania became an EMBL prospect member state in September 2015, a memorandum of understanding was signed between EMBL and the Life Sciences Center at Vilnius University (VU LSC), to foster collaboration as Lithuania progressed towards full membership. In June 2019, Lithuania became EMBL’s 27th member state. To intensify institutional synergies, a framework agreement for the establishment of the VU LSC–EMBL Partnership for Genome Editing Technologies was signed in September 2020.

The partnership builds on complementary scientific and technological strengths in the field of targeted genome modification. It will include the establishment within the LSC of a partner unit based on the EMBL model, which will employ six high-level groups of international researchers and will pursue a collaborative programme in genome editing.

The scientific focus will be the development and application of novel genome editing tools and technologies to improve our understanding of fundamental biological processes and disease mechanisms. The partnership will also promote cooperation between VU LSC and other EMBL partnership institutes, enabling the sharing of knowledge, scientific services, and scientific training.

The Nordic EMBL Partnership: supporting national research

EMBL and four Nordic research institutions stimulate scientific exchange and inspire scientific collaborations

BY DOROTA BADOWSKA

The Nordic EMBL Partnership was initiated in 2007 to connect EMBL and Nordic research institutions focusing on diverse approaches to molecular medicine, including infection biology, genomics, and translational neuroscience. Besides EMBL, the Partnership involves four Nordic nodes: the Institute for Molecular Medicine Finland (FIMM), the Laboratory for Molecular Infection Medicine Sweden (MIMS), Centre for Molecular Medicine Norway (NCMM), and the Danish Research Institute for Translational Neuroscience (DANDRITE).

The annual conference of the Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The conference of the Nordic EMBL Partnership: supporting national research

EMBL and four Nordic research institutions stimulate scientific exchange and inspire scientific collaborations

BY DOROTA BADOWSKA

The Nordic EMBL Partnership was initiated in 2007 to connect EMBL and Nordic research institutions focusing on diverse approaches to molecular medicine, including infection biology, genomics, and translational neuroscience. Besides EMBL, the Partnership involves four Nordic nodes: the Institute for Molecular Medicine Finland (FIMM), the Laboratory for Molecular Infection Medicine Sweden (MIMS), Centre for Molecular Medicine Norway (NCMM), and the Danish Research Institute for Translational Neuroscience (DANDRITE).

The annual conference of the Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The annual conference of the Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.

The Nordic EMBL Partnership is an opportunity for members to get together, exchange information across nodes, and inspire collaborations. At this year’s conference (22–25 September 2020), EMBL Director General Edith Heard welcomed participants and presented updates on EMBL’s future plans. The conference’s scientific programme comprised many talks, including several by scientists from three of EMBL’s sites. This was possible thanks to the virtual format of this year’s meeting, and reflected the interest on both sides in strengthening scientific interactions.
New fellowships to boost infrastructure

ARISE fellowships to offer first-ever comprehensive training for bioscience infrastructure operations

EMBL will soon be accepting applications for its newest fellowship programme, ARISE, which will train future research infrastructure scientists. ARISE will be the first long-term preparatory programme of its kind. A diverse group of engineers, computer scientists, mathematicians, and others will be trained to develop and run research infrastructure.

“ARISE will offer a way for technology developers to acquire expertise needed to run research infrastructure in the life sciences, and a structured way to gain knowledge previously handed down in a random way on the job,” says Tanja Ninkovic, the ARISE programme manager, who designed and will implement this offering. “This programme aims to provide a more robust backbone to the research infrastructure so central to research and development.”

Over the next five years, EMBL will train 62 fellows to become future leaders in technology development and to take senior positions in life science research infrastructure, either in academia or industry. Participants will represent diverse STEM disciplines, backgrounds, and interests, setting the stage for an expansive learning environment in which they will benefit from the knowledge of the instructors and other programme participants. Together, fellows will expand their expertise to better understand the practicalities of infrastructure, management, and regulatory issues, as well as the finer points of technology development and an overview of trends in the life sciences.

“There simply hasn’t been training in any systematic way for research infrastructure scientists, and that was a trigger that made us realise EMBL could fill this need,” says Peer Bork, a bioinformatician, Director of EMBL’s Heidelberg Scientific Activities, and ARISE programme director. “There’s nothing comparable to ARISE. New technology will keep coming and so will the need for infrastructure to support it. Its time is now.”

ARISE partner organisations – representing both academia and industry – will support the core fellowship training with long- or short-term secondments at their sites. This comprehensive experience offers exposure to different approaches to infrastructure as well as experiences to prepare fellows for positions as senior scientists or leaders of research infrastructure in a variety of sectors.

By 2025, ARISE fellows will take up roles across industry, healthcare, academia, and other sectors. This is likely to be a boon for EMBL’s member states.
EMBL invites experts and activists to discuss the effects of biodiversity loss and how scientists and wider society can respond

BY EDWARD PRIOR

Mill’s 21st annual Science and Society Conference took place from 4–5 November, near the end of a year that has seen widespread media coverage of threats to the natural world, including climate change and loss of biodiversity. Entitled ‘Our House Is Burning: Scientific and Societal Responses to Mass Extinction’, the conference drew high-profile speakers from the worlds of academia, activism, and conservation, and generated engaging discussion from a large online audience worldwide. Topics ranged from microbial diversity to the protection of the Amazon and indigenous rights, and covered issues as diverse as the sustainability of the built environment and the use of microbes on a global scale to help reverse the effects of pollution. While travel restrictions prevented a physical gathering, participants made full use of opportunities to meet with speakers virtually, posing questions and offering perspectives from a range of disciplinary backgrounds.

From speculation to testable science

The key question posed at the start of the conference was whether the Earth is currently in the midst of a mass extinction. Speakers gave a scientific overview of the loss of biodiversity during the current human-dominated age – the Anthropocene – as well as exploring key drivers of biodiversity change.

The keynote speaker on the first day of the conference was Mike Benton, a professor of palaeontology at the University of Bristol, UK. His fascinating and wide-ranging talk drew connections between palaeontological evidence and the situation on Earth today. He gave details of his work featuring climate models and fluctuations in biodiversity, showing how the study of deep time can inform our predictions about the future.

Mike’s work has been at the heart of transforming palaeobiology from a speculative subject into testable science. Palaeontologists have studied mass extinctions for over 50 years, developing knowledge about the way global environments have changed and the impact that this has had on life. As the scale of global climate change emerges, along with its impact on life on Earth, palaeontologists’ understanding of past extinction events has come to the fore.

In part, Mike’s work builds on the climate models that have been developed for use in the present. “Now that we have functioning climate models for the present day that capture at least some of the complexity of the way the world works, we can use them to look at the effects of small-scale historical changes in climate,” he explains. “Take the aridification of North Africa since Roman times as one example. We can look at what that meant for movements of wildlife. We know that there were hippos and ostriches in Egypt a thousand years ago, and that they aren’t there anymore. That’s the kind of thing we can track.”

Looking back to understand the future

Mike’s work is able to harness a similar approach to delve much further into the past. “We can go deeper in time. We use the same data that allow us to project into the future.”

But what we’re looking at is potential events over the next few centuries that are much bigger and more serious than anything like that. It’s something quite different from the extinction of the dodo, or a few species here and there. What we’re looking at is losses of tens of per cent. Perhaps thirty, forty, fifty per cent of biodiversity. It’s by looking back at the deep time mass extinctions that we can find sources of data that allow us to project into the future.”

Extinction as part of life

Some voices in the public debate on climate change highlight that extinction is a natural part of life on Earth, bringing little cause for concern, especially given that biodiversity on Earth today may be at record levels. But Mike is clear that there is a marked difference between what we might expect in the normal course of events, and the rate of extinction being recorded now. “It’s completely true to say: extinction is normal. Most species last for one or two million years. That means that, in the long history of life, more species will have died out than are currently in existence on Earth, even though biodiversity on Earth now may be at its highest ever level. Sometimes people quote those two points and then say, ‘so, why worry?’ Well, there is a big difference. The rate of extinction at the moment is between a hundred and a thousand and times higher than it ought to be. The rate and volume of extinction at the moment is right up there with a mass extinction.”
Spotlight on global youth activism

EMBL’s Science and Society Conference also involved talks from climate change activists and those seeking to radically shift the terms of the current discourse. Among the speakers was Ugandan campaigner Vanessa Nakate.

Untold stories and ignored communities
Vanessa is the founder of the Africa-based Rise Up Movement, which aims to boost awareness of environmental and climate challenges from an African perspective. In recent years she has become a well-known figure in the campaign to highlight the impact of climate change on communities that receive little media attention. But she didn’t set out to be a climate activist. “I remember wanting to do something to help the lives of the people in my community, so I started trying to understand the struggles they face in their daily lives,” she says. “It was clear that there were quite a number of challenges, things like poverty and unemployment. As my knowledge grew, I found that climate change was not just a major issue for people: it was the greatest challenge they faced.”

As Vanessa’s understanding increased, suddenly she could see the effects of climate change all around her. “It dawned on me that I had actually seen the impacts of climate change when I was growing up, without understanding their cause. The landslides, the flooding, the droughts. That was the point when I accepted that I had to become a voice in the climate movement.” Soon after committing herself to activism, she began her work to bring understanding to the cause. This included going on strike every Friday, along with other young climate campaigners from around the world.

The road to activism
The Science and Society Conference explored how the personal experiences, environment, and cultural backgrounds of activists influence their chosen paths. Vanessa faced significant challenges from those around her. “People found me very weird!” They said I was embarrassing myself, wasting my time,” she explains. “Some of the reactions were really quite unpleasant. I remember my school put a lot of weight on values like respect and dignity, and I was viewed as going totally against those kinds of values when I took to the streets with a placard.”

But even in those early, uncertain times, she found glimmers of hope. “I remember a man talking to me in the street. He was an older farmer, and he said that he agreed with what I was doing. He explained that he had witnessed change in the weather patterns, how his crops had been affected because of the increasingly uneven distribution of rainfall. He believed we had to demand change from our leaders.” Understanding the struggles that were affecting the daily lives of so many, but receiving so little attention from those in power, gave Vanessa the resolve to keep going despite the disapproval she faced from many in the early days.

Discrimination and climate justice
Getting people on board with her work has become easier as her profile has grown. But Vanessa’s experience has made her deeply aware of the intersectional nature of activism. Back in January 2020, she was cropped out of a global news photo of young climate activists taken at the World Economic Forum in Davos, Switzerland. The experience reinforced the exclusion that she had sensed even before the incident. “It was already quite disturbing that I was the only activist from my country, actually the only one from Africa as a whole. When I was cropped out of that photo it was a clear form of discrimination: my presence was not being valued in any way.”

A large part of Vanessa’s work deals with the intersection between climate justice and racial justice. She sees effective action as something that can only come about if we move beyond the traditional boundaries and discussions around environmentalism. “When you look at the communities that are most affected by climate change and pollution, they are communities of colour, communities of black people, communities of indigenous people in the Global South. It’s these people who are facing most of the wrath of climate change. You can even see this when you look at wealthy countries. Take the United States, for example: the communities most affected by pollution are communities of colour and communities of black people. Racial injustice is an important fight in the climate movement: we cannot achieve climate justice without racial justice.”

Vanessa’s participation in the EMBL conference is part of her work aimed at sounding the alarm. “I really feel like too many people think that climate change is a minor issue, simply because they haven’t personally seen its effects or felt its force. It is here. This is happening right now. It is destroying livelihoods and lives. We’ve got to get people to understand, so that there can be more pressure on leaders to really take action.”
Tackling tropical diseases

Members of the EMBL community are working to improve our understanding of the parasites that cause malaria and sleeping sickness

BY MYLÈNE ANDRÉ AND LUCA TANCREDI BARONE

The deadliest vector-borne disease is malaria, which claims 400,000 lives each year, most of them in Africa. Malaria depends on two organisms, both of which are necessary for the disease to attack: a female Anopheles mosquito and a tiny but very sophisticated single-celled parasite called Plasmodium. The cycle begins when a mosquito bites a human to feed on their blood. If the insect hosts the parasite, it carries an infective form called a sporozoite, which can be passed on to its human victim. Once the sporozoite reaches the bloodstream, it moves towards the liver. Here it can reproduce and create thousands of offspring of another form, called merozoites. These attack red blood cells, where they reproduce. The red blood cells eventually burst, liberating yet more merozoites, and this is when patients experience fever and the other symptoms of malaria.

EMBL alumnus Freddy Frischknecht, a professor at Heidelberg University, carries out research on Plasmodium. He focuses especially on the extraordinary method the parasite uses to move around inside its host. "Everybody assumed that the sporozoite was injected by the mosquito directly into the blood, but instead they’re injected into the skin," he explains. "From there, Plasmodium looks for a blood vessel."

Gliding through the blood

Research in Freddy’s group has revealed how the parasites move ten times faster than any other migrating cell in the body. “The fastest moving cell in our body is the neutrophil cell, part of the immune system. It’s as if the fastest police car runs at a tenth of the speed of the villain,” he says.

Freddy and his group have made important steps in understanding how Plasmodium manages to be that fast. They found that the parasite tries to avoid sticking to a substrate. Instead it glides, which it can do thanks to an interplay between filaments of a protein called actin, which determine the shape and movement of the cell’s surface. Recent work led by group leader Christian Löw at EMBL Hamburg has provided further insights into the structure of the proteins that enable this gliding motion (p. 11).

Freddy is working on a type of Plasmodium that attacks mice: his group discovered that if you modify the gene sequence coding for some proteins involved in the migration mechanism, the parasite could still infect mice, but the mice would survive. “We think this is because the parasite then multiplies more slowly in the blood, and the immune system is better at controlling fewer parasites,” he says. His goal now is to generate a human-infecting parasite that grows more slowly than the normal one, but can still be transmitted by a mosquito. Just as in mice, the hope is that the human immune system would be capable of fighting off this form of the parasite, enabling the host to gain immunity to other strains of Plasmodium that infect humans. This is the kind of novel approach that’s needed to tackle malaria, since designing a conventional vaccine – using proteins on the parasite’s surface – is extremely difficult, as there are many such proteins and they undergo significant changes during the parasite’s life cycle. There is currently only one approved malaria vaccine, which offers protection in only about 30% of cases and for a limited time.

Monitoring malaria progression

At EMBL Barcelona, group leader Maria Bernabeu is tackling malaria from a different perspective. Her research – for which she was recently awarded a €1.5 million ERC Starting Grant – focuses on cerebral malaria, a deadly complication of the disease that involves severe neurological symptoms, and is responsible for approximately three-quarters of malaria deaths worldwide. “One of the things that prevents us from understanding how this disease evolves is that we don’t have direct access to the brain until after a patient has died, so we do not understand its progression,” Maria explains. A collaboration between her group and clinicians at Işap General Hospital (IGH) in Rourkela, India, will help overcome this problem. IGH is one of the few places in the world using MRI scanning to study the brains of patients with malaria, offering a way to closely monitor the development of the disease in living patients.
Tackling tropical diseases

Breaking the blood–brain barrier

The brain is usually protected from infection by the blood–brain barrier (BBB). Maria’s group is studying how cerebral malaria breaks down this barrier. They are growing cells on collagen scaffolds to recreate living human blood microvessels of the same size and shape as the real ones in the BBB. “Through this blood vessel tree, we can flow blood cells – both healthy ones, and those infected with malaria,” Maria says. “This allows us to recreate aspects of the human pathology in a dish – using human cells and the human-specific version of the parasite – to better understand the mechanism of cerebral malaria.”

This is the first time anyone has used artificial blood vessels to study malaria, and the methods being developed in Maria’s group could bring us an important step closer to tackling this disease. “If you find a strategy to prevent the blood–brain barrier effect, it will cause huge problems for the brain,” says Eva, whose group recently received a grant from the French National Research Agency (ANR) for their research.

Unravelling RNA processing

At EMBL Grenoble, group leader Eva Kowalinski and members of her lab are carrying out research on Trypanosoma brucei, a genus of single-celled insect-transmissible parasites that can cause human and animal diseases. The Kowalinski group studies RNA – a molecule that plays an important role in carrying genetic information to be converted into a gene product such as a protein. The group uses structural biology, biochemistry, and cell biology methods to study the mechanisms of protein–RNA interactions and RNA metabolism, the ways in which RNA molecules are produced, modified, processed, and broken down.

Members of the group study RNA molecules in Trypanosoma parasites to understand how the genetic information is processed, modified, or even rewritten. These pathways differ significantly between Trypanosoma and humans. “We study in particular how the protein complexes involved differ from those in human cells. Trypanosomes have very special forms of RNA processing. From a fundamental research aspect, it’s really interesting to understand how it works,” says Eva, whose group is studying RNA processing pathways for proliferation of trypanosomes. Targeting these pathways with drugs could prevent the parasite from reproducing or – in the best case – could kill the parasite. By determining the structures of the proteins involved in trypanosomal RNA processing, scientists can begin to design drugs that specifically target only the proteins of the parasite and not the corresponding proteins – if they exist – in humans. “The more a target differs from the human one, the more likely it is that a drug can work effectively without causing the kind of strong side-effects that are seen in current Trypanosoma treatments,” says Eva.

Finding a target

There is a growing quantity of cell biology data demonstrating the importance of the RNA processing pathways for proliferation of trypanosomes. Targeting these pathways with drugs could prevent the parasite from reproducing or – in the best case – could kill the parasite. By determining the structures of the proteins involved in trypanosomal RNA processing, scientists can begin to design drugs that specifically target only the proteins of the parasite and not the corresponding proteins – if they exist – in humans. “The more a target differs from the human one, the more likely it is that a drug can work effectively without causing the kind of strong side-effects that are seen in current Trypanosoma treatments,” says Eva. “If this happens, it will cause huge problems for the brain,” says Eva. “The current COVID-19 crisis shows us the importance of fundamental research on infectious diseases. We already need to be thinking ahead to what could be the next global challenges. Rigorous research needs time. Investing in research on diseases that we predict could become more widespread in the coming years is really important, to avoid human catastrophes.”
EMBL group leader Julia Mahamid uses cryo-electron microscopes like the one pictured here to study molecules in their natural context within the cell.

BY IVY KUPEC

The lab looks like many others. PhD students and postdocs alternate between staring deeply at computer screens and gliding office chairs across the floor to consult with a colleague. There’s the concentrated hush of scientists at work. But the quiet belies the energy and excitement that members of the Mahamid group convey as they talk about their work and the technology they’re helping to shape.

“Complex biology can be explained by multifaceted but simple interactions, and what this technology provides seems like magic,” says Xiaojie Zhang, a postdoc who uses the technology the group is quickly developing and mastering to study stress granules – a type of structure involved in the cell’s stress response – in HeLa cells. She laughs. “The reason I get excited is that seeing is believing, and we can potentially see at near atomic resolution how molecules interact, directly in their biological context.”

While cryo-electron tomography (cryo-ET) was first envisioned in 1968, the advances the Mahamid group are bringing to this 3D method for studying molecules directly inside cells are new, and are likely to greatly expand its use. A tour through their projects hints at solutions to molecular puzzles and promises a future with innovative automated technology that will change the way biologists think about cells.

“These past few years have been transformative for those of us engaged in cryo-ET,” says group leader Julia Mahamid. “We’re at the point of pushing what was once thought to be a dream to become a high-throughput method. Two years ago, we didn’t think this kind of capability was possible. Now, here we are.”

Julia first began working with cryo-ET as a postdoc at the Max Planck Institute of Biochemistry in Martinsried, near Munich. Her mentor was Wolfgang Baumeister, who pioneered key aspects of cellular cryo-ET. Since 2017, Julia has led her own group at EMBL, working with them to further develop and refine this technique.

**Cryo-ET evolving**

Cryo-ET piggybacks onto another state-of-the-art technique, cryo-electron microscopy (cryo-EM), which emerged from the pioneering work of Nobel laureate Jacques Dubochet at EMBL in the 1980s. Cryo-EM involves rapidly freezing samples at very low temperature and imaging them using a beam of electrons. By freezing samples, it’s possible to reduce the damage caused by the electron beam, and the rapid freezing process prevents the formation of ice crystals, which would damage and distort the fine structure of molecules.

Scientists can use cryo-EM to study biological structures at the atomic level. It’s possible to glimpse structures in high resolution, but this requires scientists to create highly purified samples taken out of their natural context of the cell. The age of cryo-ET seized on technical advances in electron microscopes, detectors, and computational analysis to create something akin to a CT scan for cells. It uses some of the same instruments as cryo-EM, but expands what scientists can see and do.

With cryo-ET, scientists can produce 3D snapshots of a cell to observe the activity and interactions of the molecules inside it at the highest resolution. Researchers prepare specimens by growing cells on a thin gold or titanium grid overlaid with a thin film that supports electron microscopy samples. They rapidly freeze the grid and then use a focused ion beam to shave away surplus material bit by bit, producing a thin layer, or lamella, around 200 nanometres (one five-thousandth of a millimetre) thick. A critical factor is that the cells are unperturbed, frozen in time, and the molecules within them are visualised in situ – in their natural habitat – having experienced a minimum of interference.
Seeing deeper inside cells

― At the moment, the skill set required to do cellular cryo-ET is fairly unique, but efforts towards automation will streamline the processes and make it a far more routine, push-button technique,‖ Julia says. ―Scientists will be able to spend far more time thinking about experimental design than how to get their samples imaged.‖

Mauricio Toro-Nahuelpan, a postdoc in the Mahamid group, recalls his work of only three or four years ago when automation was still just a dream and he’d need to be in the lab for 72 hours in a row, baby-sitting his samples so he could manually reposition them to capture the high-resolution imagery.

While samples ultimately need to be about 200 nanometres thick, they might begin around 5,000 nanometres (one two-hundredth of a millimetre) in the case of yeast cells, or even bigger in other samples. Scientists can shave away or ‘mill’ the sample to achieve the thin lamella. Its thinness allows them to capture high-resolution images inside the cell.

―There are so many technological limitations to this work, but this is no longer one of them,‖ Sara says. ―This automation and high throughput mean we can tackle even more complex biological questions.‖

When cells are placed on the grid used for creating cryo-ET images, they grow randomly across it. For the milling step, however, cells must be positioned at specific locations to be accessible for milling. To help with this issue, Mauricio has led the way in developing a micropatterned grid so cells can selectively grow at specific locations that have a mill. Micropatterning not only provides a good substrate for culturing cells, but also ensures a surplus of cells available for the milling step, increasing the throughput. Micropatterning, together with the automation of the milling step by Sara and colleagues, is significantly helping to streamline the cryo-EM pipeline for cells.

―Micropatterning also allows us to create complex shapes, such as stars and crosses, on the grid where cells can grow,‖ Mauricio says. ―In this way, cells adopt the shape of these patterns, rearranging their internal architecture. We can use these patterns to study cellular mechanical behaviour, expanding the scope of questions that can be addressed by cryo-ET.‖

Layering techniques for better outcomes

Another group member, Edoardo D’Imprima, is tweaking the cryo-ET process to better pinpoint how, where, and when tumours first arise within a healthy tissue. His work involves organoids: 3D tissue cultures often described as mini organs because, even though they may not look like the organ they represent – mammary glands in the case of Edo’s work – they’re capable of the same functions.

Organoids are much larger and more complex than yeast cells, HeLa cells, or any other samples studied in the Mahamid group. To have a comprehensive structural understanding of organoids, one single imaging technique is not sufficient. Edo’s aim is therefore to develop an integrated pipeline that encompasses four other imaging techniques across different spatial scales – from millimetre-sized to near-atomic details.

Maintaining a frozen state without sample-distorting formation of ice crystals is a major challenge for Edo in using cryo-ET for his research. To solve this problem, he applies high-pressure freezing, in which a specimen is exposed to liquid nitrogen but at very high pressure (2,000 bar) to slow down ice formation.

―We have to ‘trick’ physics and use the high-pressure freezing approach,‖ Edo says. ―That’s the beauty of water – it always gives you a chance to trick physics.‖

Like Edo, other group members incorporate various observational tools to expand what they can see and learn from cryo-ET. Xiaojie, for example, combines live-cell imaging, cryo-confocal light microscopy, and cryo-ET in her research involving HeLa cells. To observe dynamic cellular structures, she uses genetically modified cell lines that produce fluorescent labels on the key component of the stress granules she is studying. By overlaying images produced by other methods, showing cells under stress at various time points, Xiaojie can more precisely navigate her cryo-ET images. Eventually high-resolution structural information will help to provide a full perspective on how these dynamic structures assemble and disassemble, when cells respond to and are released from stress.

Earlier this year, Liang Xue, a PhD student in the group, and collaborators published results from a study involving Mycoplasma pneumoniae – a bacterium that causes a mild form of pneumonia. The research team combined cryo-electron tomography with cross-linking mass spectrometry and computer modelling to refine their findings, producing the highest-resolution images of cells ever obtained. The scientists were able to confirm that, in bacterial cells, which have no nucleus, the processes of transcription and translation can occur with cryo-ET.
Seeing deeper inside cells

and translation – which cells use to convert information from DNA to proteins – can be coupled together, with the molecular machinery for these processes in physical contact. This had been a hypothesis for decades, but had never been confirmed. They also learned that the observed molecular activity in its natural context inside cells is different from what had been observed in previous studies outside the cell, further validating the importance of the in situ perspective.

“Image processing is a significant challenge. More than large datasets and heavy computation, we need new concepts and new algorithms,” Liang says. “It’s never easy and perfect, but that’s why we do it. With the new methodologies, we hope to lead structural biology into a new era: cellular, physiological, integrative, and systematic.”

Tomorrow’s cryo-ET

The innovative spirit isn’t lost on others outside the group, who look at the methods being refined and see how cryo-ET could expand their own research. In an interview earlier this year about his research on influenza, head of EMBL Grenoble Stephen Cusack explained how the work of the Mahamid group could help him to look directly at one of the flu virus’s key enzymes – influenza polymerase – and see it at work inside the nucleus of its host cell.

Many other scientists are excited by the potential of cryo-ET. Universities around the world, Julia explains, are investing in the technology so they too can make new leaps forward in understanding cellular structure and function. Cryo-ET has emerged as the most powerful technique for the structural understanding of biological molecules in their natural context.

“The big advantage of cryo-ET is how it opens up possibilities to discover new things,” Julia says. “You aren’t labelling one specific thing and only looking at what that thing is doing. Instead, you’re looking at everything at once, over a very wide range of spatial resolutions. The discovery potential is enormous.”

Julia acknowledges that this can be both a blessing and a curse, as it adds dimensions that bring a new complexity to the research. A scientist may begin with the intention of investigating one area but then encounter unanticipated new questions that challenge their assumptions. “Our current bottleneck is mining our data to get information from the images. Right now, we have 3D images, but we need to somehow convert them into a scientific understanding. This is where the field still needs to develop,” she acknowledges.

In the next 10 years, microscopes and detectors will continue to improve, but the computational side is where Julia sees the greatest likelihood for growth. In an era when artificial intelligence is rapidly developing, finding a way to incorporate AI, deep learning, and computer vision into cryo-ET image processing will be important.

“There’s a state of mind that develops in working with cryo-ET,” Julia says. “Scientists working in this field – like those in my group – are excited about science and don’t see limitations. That’s true for all method developers: we can’t be restricted by what’s available. We are problem solvers. If a tool that we need doesn’t exist, we have to create it.”

CLARIFICATION: EMBL Archivist Anne-Flore Laloë was credited as an author of the article ‘Fallingwater filled with mice’, which appeared in Issue 94 of EMBLetc. (p. 36), in recognition of the fact that she had carried out the oral history interview on which the text was based. However, we would like to emphasise that Anne-Flore was not involved in editing this text for publication. We apologise for any confusion this may have caused.
EMBL Fellows’ Career Service celebrates first birthday

Early-career scientists benefit from growing professional development programme

By Ivy Kupec

Tobias Wenzel is a biophysicist who knew early on in his EMBL postdoc where he wanted to go and what he wanted to do next. His eyes were on a tenure-track position at a university in Chile where he could expand the research he began at EMBL, leading a group of his own. While he had clear goals, he still needed guidance on the best way to achieve them.

And after Nadezda Volkova, a mathematician, completed her PhD in cancer genomics at EMBL’s European Bioinformatics Institute (EMBL-EBI), she decided to move outside academia. In many ways, this job market was uncharted territory. Finding the way to best present herself and identifying appropriate jobs to apply for would be critical to her success.

Tobias and Nadezda ended up finding exactly the help they needed in the same place: the EMBL Fellows’ Career Service—now celebrating its first year of supporting both PhD students and postdocs. Led by career advisors Rachel Coulthard-Graf and Patricia Cabezas, this service supports fledgling PhD students and postdocs from outside EMBL.

“We learned that the needs of PhD students are slightly different from those of postdocs,” Rachel says. “The postdocs tend to focus specifically on continuing their research and whether to do it within academia or industry. PhD students, on the other hand, seem open to a lot more possibilities for what they might do with their science education.”

The COVID effect

Starting a new programme like the EMBL Fellows’ Career Service is challenging at any time, but starting one and then recalibrating it for a pandemic presents new, unexpected considerations. For the EMBL Fellows’ Career Service, it shifted the focus from in-person encounters to maximising the service’s online space. The challenge was to keep the service feeling personalised.

“In some ways COVID had a positive impact,” Patricia says. “Beforehand, we had the challenge of how to equally serve all six EMBL sites. Then COVID forced us online, where we could offer regular workshops to serve fellows from all six sites at once, suitably

Providing support to EMBL fellows

As part of the EMBL International Centre for Advanced Training, the programme offers services that range from personalised individual career guidance sessions and job application materials checks to a variety of career workshops and events. Together with the Postdoc Office, Rachel and Patricia also co-organise the EMBL Complementary Scientific Skills Programme, which offers training on non-technical skills required for a scientific career, such as scientific presentation skills and project management.

“We learned that the needs of PhD students are slightly different from those of postdocs,” Rachel says. “The postdocs tend to focus specifically on continuing their research and whether to do it within academia or industry. PhD students, on the other hand, seem open to a lot more possibilities for what they might do with their science education.”

The proof is in the testimonials

This year has been an important one, as a result of COVID and an unusual job market, so use of the service and survey results have provided important insights. Approximately 20% of fellows have attended individual career guidance sessions, with more than 30% returning for follow-up appointments. A survey of participants showed that 100% would recommend the service to a colleague.

“The consultation I had was super helpful because it taught me what language and forms to use to describe my experiences and achievements, and what key phrases a recruiter would look for,” Nadezda says. “We initially thought that a position I brought as an example was too high for my experience level, but after two rounds of tailoring my CV I got the courage to apply, and then successfully interviewed and received an offer—a Senior Cancer Analyst position at Genomics England— the position I’m in now.”

Tobias, despite heading in a different career direction, shares similar satisfaction. “I was very clear about where I wanted to go and what I wanted to do,” he says of his assistant professor position, in which he heads his own lab at Pontificia Universidad Católica de Chile. “A grant-writing workshop from the EMBL Complementary Scientific Skills courses, and several others, plus one-on-one guidance were invaluable, and helped me get familiar with non-technical skills that are all required for the application, as well as to fill out the role I’m now stepping into.”

As Patricia and Rachel look to the future, they’re also looking back at participant feedback. “We’re further ahead in some ways than we expected,” Patricia says. “At this point, we assess what is working, what participants are still seeking, and where we can help provide further information and support.”

“We had plans to expand our reach...COVID has forced us to do that now”

BY IVY KUPEC

The COVID effect

Starting a new programme like the EMBL Fellows’ Career Service is challenging at any time, but after two rounds of tailoring my CV I got the courage to apply, and then successfully interviewed and received an offer—a Senior Cancer Analyst position at Genomics England—the position I’m in now.”

Tobias, despite heading in a different career direction, shares similar satisfaction. “I was very clear about where I wanted to go and what I wanted to do,” he says of his assistant professor position, in which he heads his own lab at Pontificia Universidad Católica de Chile. “A grant-writing workshop from the EMBL Complementary Scientific Skills courses, and several others, plus one-on-one guidance were invaluable, and helped me get familiar with non-technical skills that are all required for the application, as well as to fill out the role I’m now stepping into.”

As Patricia and Rachel look to the future, they’re also looking back at participant feedback. “We’re further ahead in some ways than we expected,” Patricia says. “At this point, we assess what is working, what participants are still seeking, and where we can help provide further information and support.”

“We had plans to expand our reach...COVID has forced us to do that now”

The proof is in the testimonials

This year has been an important one, as a result of COVID and an unusual job market, so use of the service and survey results have provided important insights. Approximately 20% of fellows have attended individual career guidance sessions, with more than 30% returning for follow-up appointments. A survey of participants showed that 100% would recommend the service to a colleague.

“The consultation I had was super helpful because it taught me what language and forms to use to describe my experiences and achievements, and what key phrases a recruiter would look for,” Nadezda says. “We initially thought that a position I brought as an example was too high for my experience level, but after two rounds of tailoring my CV I got the courage to apply, and then successfully interviewed and received an offer—a Senior Cancer Analyst position at Genomics England—the position I’m in now.”

Tobias, despite heading in a different career direction, shares similar satisfaction. “I was very clear about where I wanted to go and what I wanted to do,” he says of his assistant professor position, in which he heads his own lab at Pontificia Universidad Católica de Chile. “A grant-writing workshop from the EMBL Complementary Scientific Skills courses, and several others, plus one-on-one guidance were invaluable, and helped me get familiar with non-technical skills that are all required for the application, as well as to fill out the role I’m now stepping into.”

As Patricia and Rachel look to the future, they’re also looking back at participant feedback. “We’re further ahead in some ways than we expected,” Patricia says. “At this point, we assess what is working, what participants are still seeking, and where we can help provide further information and support.”

“We had plans to expand our reach...COVID has forced us to do that now”

The COVID effect

Starting a new programme like the EMBL Fellows’ Career Service is challenging at any time, but after two rounds of tailoring my CV I got the courage to apply, and then successfully interviewed and received an offer—a Senior Cancer Analyst position at Genomics England—the position I’m in now.”

Tobias, despite heading in a different career direction, shares similar satisfaction. “I was very clear about where I wanted to go and what I wanted to do,” he says of his assistant professor position, in which he heads his own lab at Pontificia Universidad Católica de Chile. “A grant-writing workshop from the EMBL Complementary Scientific Skills courses, and several others, plus one-on-one guidance were invaluable, and helped me get familiar with non-technical skills that are all required for the application, as well as to fill out the role I’m now stepping into.”

As Patricia and Rachel look to the future, they’re also looking back at participant feedback. “We’re further ahead in some ways than we expected,” Patricia says. “At this point, we assess what is working, what participants are still seeking, and where we can help provide further information and support.”

“We had plans to expand our reach...COVID has forced us to do that now”

By Ivy Kupec

Tobias Wenzel is a biophysicist who knew early on in his EMBL postdoc where he wanted to go and what he wanted to do next. His eyes were on a tenure-track position at a university in Chile where he could expand the research he began at EMBL, leading a group of his own. While he had clear goals, he still needed guidance on the best way to achieve them.

And after Nadezda Volkova, a mathematician, completed her PhD in cancer genomics at EMBL’s European Bioinformatics Institute (EMBL-EBI), she decided to move outside academia. In many ways, this job market was uncharted territory. Finding the way to best present herself and identifying appropriate jobs to apply for would be critical to her success.

Tobias and Nadezda ended up finding exactly the help they needed in the same place: the EMBL Fellows’ Career Service—now celebrating its first year of supporting both PhD students and postdocs. Led by career advisors Rachel Coulthard-Graf and Patricia Cabezas, this service supports fledgling PhD students and postdocs from outside EMBL.

“We learned that the needs of PhD students are slightly different from those of postdocs,” Rachel says. “The postdocs tend to focus specifically on continuing their research and whether to do it within academia or industry. PhD students, on the other hand, seem open to a lot more possibilities for what they might do with their science education.”

The COVID effect

Starting a new programme like the EMBL Fellows’ Career Service is challenging at any time, but after two rounds of tailoring my CV I got the courage to apply, and then successfully interviewed and received an offer—a Senior Cancer Analyst position at Genomics England—the position I’m in now.”

Tobias, despite heading in a different career direction, shares similar satisfaction. “I was very clear about where I wanted to go and what I wanted to do,” he says of his assistant professor position, in which he heads his own lab at Pontificia Universidad Católica de Chile. “A grant-writing workshop from the EMBL Complementary Scientific Skills courses, and several others, plus one-on-one guidance were invaluable, and helped me get familiar with non-technical skills that are all required for the application, as well as to fill out the role I’m now stepping into.”

As Patricia and Rachel look to the future, they’re also looking back at participant feedback. “We’re further ahead in some ways than we expected,” Patricia says. “At this point, we assess what is working, what participants are still seeking, and where we can help provide further information and support.”

“We had plans to expand our reach...COVID has forced us to do that now”
As he enters retirement, Head of EMBL Rome Phil Avner reflects on his scientific career and memories from his time as Head of EMBL’s site in Italy

BY ROSSANA DE LORENZI

The farewell party had been planned for months. It was meant to be in June, when the mild weather and the scent of the flowers would provide the perfect setting for enjoying some good Italian food and homemade beer in the beautiful courtyard at EMBL Rome.

It was being arranged in honour of Phil Avner, retiring after a long career in science and eight years as Head of EMBL Rome. Amid the coronavirus pandemic, however, everything had to be rethinked. It took some creativity to organise a proper farewell party via Zoom, but the fancy background set up by Phil’s personal assistant Helen Barker – and the affection of the people who attended, including EMBL staff and alumni – succeeded in making it a memorable and emotional event.

Here, Phil reflects on a career at the forefront of developmental biology and epigenetics, marked by changes both in the places he has worked and the scientific questions he has explored.

What have been your main challenges and achievements at EMBL Rome?

When I arrived, my initial preoccupation was to make sure that we were more clearly focused on our scientific interests, and raised our profile to be considered a fully worthy partner first of all by the rest of EMBL. Over time, as we made recruiting, we have exclusively focused on epigenetics and neurobiology. We then moved towards defining a core of potential partner laboratories interested in what we were doing. This work is very much ongoing, supported by the ‘EMBL in Italy’ alumni events, with the aim of building confidence with other partners and a platform for interactions over the long term. A major thrust of the ‘EMBL in Italy’ events has been to move the meetings out of purely academic settings in Italy if they wish to.

What will you miss most?

The people. There’s no doubt. An amazingly warm community. There’s so much willingness at EMBL Rome to make things work, and you don’t get that everywhere. At EMBL Rome, with 99% of the recruitment we’ve done, we’ve managed to recruit people who are competent, willing, and good community members, and that’s amazing. I feel blessed by the people I’ve worked with over the last few years.

Overall I think this is a super interesting and stimulating time for everyone working at EMBL, with the new lines of research that EMBL is developing and promoting, and a new Director General. I know her very well: she was my first postdoctoral student at the Institut Pasteur, and a fantastic scientist.

What will you miss most?

The people. There’s no doubt. An amazingly warm community. There’s so much willingness at EMBL Rome to make things work

Tell us more about your career.

In my career, I’ve always moved and tried to stretch myself with new ideas. I was also very keen on living in Europe. In 1972 I moved to the French National Centre for Scientific Research (CNRS) in Gif-sur-Yvette as a postdoc in the lab of geneticist Piotr Słonimski, a Polish expatiate and a super scientist. It was an amazing time, just after 1968 – I was moving from an English laboratory where we talked about football, football, football, to a French laboratory where almost all they were talking about was politics. This cultural ferment and stimulating environment didn’t just remain linked to politics, but spread across the work we were doing.

The lab and I had good publications and Słonimski was an extraordinary person and yeast genetist, but I had the impression that things were going so well that I could well spend my entire life in front of Petri dishes and yeast, and I wanted to change. I followed the advice of another distinguished scientist – Boris Ephrussi – and I ended up working with François Jacob at the Institut Pasteur, who, at the time, was part of a generation of scientists all working on bacterial systems, who were moving into the field of developmental biology.

My work on X-chromosome inactivation started at the Institut Pasteur and was carried on a little bit in Rome. However, we tried not to stay completely wedded to a single system and started working on human genetics using mouse models. We made some big contributions to the mapping of mouse genes at a time when sequencing was not around. We were interested in applying such data to diseases, and got involved with excellent clinicians to work on type 1 diabetes in the mouse.

I’ve based my career on a degree of change and flexibility. Each time you change, it’s very stimulating. You lose expertise, and you lose some of your contacts – you have to be prepared for that. But it keeps you awake and you meet a lot of very interesting people.

“There’s so much willingness at EMBL Rome to make things work”
Awards & honours

Alexander Aulehla, Group Leader and Senior Scientist, and Paul Edicok, Associate Director of EMBL-EBI Services, have been elected EMBO Members, in recognition of their research excellence and outstanding achievements in the life sciences.

Alex Bateman, Senior Team Leader – Protein Sequence Resources at EMBL-EBI, has been elected as a Vice-President of the International Society for Computational Biology (ISCB). The ISCB is a scholarly society for advancing understanding of living systems through computation and for communicating scientific advances worldwide.

Camille Goemans, a postdoc in the Tyypa group, and Agnese Loda, a postdoc in the Beard group, have received L’Oréal–UNESCO For Women in Science fellowships from the L’Oréal–UNESCO For Women in Science programme. Their awards, made as part of the Young Investigator Fund, are also received the German National Programme, part of the Schering Stiftung and the Fritz Thyssen Foundation, Germany.

Joanna Wandzik, a PhD student in the Diz-Muñoz group, has received an award from the Young Investigator Fund for Innovative Research Ideas, run by the Schering Stiftung and the Fritz Thyssen Foundation, Germany.

Christopher Reinkemeier, a PhD student in the Lemke group, has received the International Birnstiel Award for Doctoral Research in Molecular Life Sciences. The award acknowledges outstanding talent in molecular life sciences and celebrates research successes of young scientists.

Mehrnoush Rayner
Head of Alumni Relations

Building communities in challenging times

We may not have been able to meet in person this year, but the situation we find ourselves in led to a uniquely inclusive online World Alumni Day in July – thank you to everyone who contributed and got involved, from the USA to the UAE!

The occasion enabled former staff to gain an insight into plans for EMBL’s new scientific Programme from Director General Edith Heard, and to learn of a new initiative launched in support of EMBL’s future directions by EMBL Director Matthias Heiner. Find out what they said on p. 38.

Finally, our alumni event programme continues online, so please do keep checking and registering (bit.ly/embl-alumni-events). It’s been lovely to see so many new faces this year, and we hope to meet many more of you in the coming months.

In memory...

…of colleagues and good friends we have lost in 2020.

Our thoughts are with them and their loved ones.

Viktor Rankwitz

Kathryn Howell

Hermann Bujard
EMBL: Group Leader, Cell Biology and Biophysics, 1976–1987

Guillem Casanovas
EMBL: PhD student, MMPU, 2006–2011
Director General Edith Heard previewed EMBL’s future directions at EMBL World Alumni Day

EMBL Director General Edith Heard gave alumni around the world an insight into EMBL’s future directions as they celebrated EMBL World Alumni Day 2020 in July. Approximately 150 former and current staff members joined the annual event, which this year took place fully online.

During World Alumni Hour, participants also heard from EMBL Director Matthias Hentze as he introduced EMBL’s Environmental Research Initiative to the alumni community.

**Exploring the molecular basis of life in context**

Offering a preview of EMBL’s forthcoming five-year Programme, Molecules to Ecosystems, which will begin in 2022, Edith explained that EMBL will remain true to its scientific ambition of understanding the molecular basis of life, and will build on this to understand life in the context of its environment. This means proudly maintaining EMBL’s tradition of excellence in fundamental research and applying cutting-edge technology and scientific expertise to explore new research questions. Some of these fascinating questions relate to major societal challenges. “EMBL can really rise up to the challenge of understanding at a molecular level how organisms exist in the context of environmental parameters, be that microbes in the human gut or marine organisms in oceans that are constantly adapting and responding to environmental changes,” she said.

Edith explained how EMBL’s unique technologies, dynamic staff turnover, and interdisciplinary approach make it ideally placed to harness molecular biology to tackle big scientific questions that will advance our knowledge of the molecular basis of life and inform solutions to societal challenges. EMBL will continue to build collaborations across Europe to drive forward impactful life science research.

**Molecules to ecosystems**

Building on EMBL’s existing strengths, the new Programme includes several exciting scientific areas in which life can be explored in a variety of contexts. “This Programme comes at a time when there is a pressing need to understand living systems in the context of environmental change,” said Peer Bork, Director of EMBL’s Heidelberg Scientific Activities, speaking after the event. “By using EMBL’s longstanding expertise in molecular biology and applying powerful experimental, computational, and theoretical approaches, we will gain valuable knowledge about the impact of the environment on living systems, and the impact of organisms on their environment; both will help to inform the response to global challenges like climate change, pollution, or loss of biodiversity.”

Key areas to build on will include the study of how molecules, cells, tissues, whole organisms, and populations respond to environmental changes. Researchers will also seek to elucidate some of the molecular mechanisms that underlie the way microbes, algae, plants, and animals on Earth respond to such changes. EMBL will advance current research to understand microbes, their functions, and their interactions in various communities. Infection biology, from both the host and pathogen perspective, will also feature prominently. The effect of the environment on humans, both at the individual and population level, will be another important area of focus.

Edith praised EMBL’s existing and growing expertise in data science, which will be key to the organisation’s future success. EMBL’s experimental and data services, training and innovation will also be core components of the new Programme.

**Building bridges from molecular biology**

Collaboration was central to the development of the Programme, and will continue to be important in the future. “It’s about building bridges from molecular biology and bringing together people from different areas to work with us,” said Edith, “from epidemiologists and ecologists to mathematicians and theoreticians.”

To support this, EMBL hopes to further its engagement activities, create new sabbatical programmes, and launch new initiatives with young scientists, including a visitor programme, summer schools, and other training opportunities. Training activities at EMBL will support a new generation of researchers looking to apply molecular technologies and approaches to explore life in the context of the environment.

Edith also highlighted the key role that former staff will play as ambassadors. “Alumni are an important part of EMBL because you represent where we came from and where we’ll be going to,” she said.

**The Environmental Research Initiative**

Following Edith’s talk, EMBL Director Matthias Hentze introduced the Environmental Research Initiative (ERI) to the alumni community. The ERI aims to support EMBL’s future directions and enable creative new research across all EMBL sites to tackle some of the biggest environmental challenges.

By harnessing the power of EMBL’s cutting-edge technologies and world-class infrastructure, interdisciplinary collaborative scientific culture, proven research mentorship capabilities, and global strategic partnerships, ERI will empower top research scientists to deepen our understanding of the fundamental principles of the environmental challenges we face, paving the way for innovative, impactful, and sustainable solutions.

If fundraising efforts are successful, ERI will complement five-year funding from EMBL’s member states. “ERI, drawing on everything that EMBL has and will develop, is a synergistic experimental opportunity for the EMBL community to contribute to something that is urgently needed,” said Matthias. ERI is currently undergoing strategic planning and its roadmap includes three phases: a catalyst project (which will be supported by seed funding from donations this year), a pilot phase, and – if proven successful – a third phase, during which new groups funded by donations to ERI will become part of EMBL’s research activities, provided that ERI’s fundraising efforts succeed.

Highlighting the important role that alumni will play in making ERI a success, Matthias said: “We are looking for a network that identifies with the idea and that wants to contribute its own ideas and connections.”

The next EMBL World Alumni Day will take place on 16 July 2021 – please mark your diary.

---

BY TOM FURNIVAL-ADAMS

---

**FORTHCOMING ALUMNI EVENTS, INCLUDING THE EMBL ALUMNI AWARDS CEREMONY:**

bit.ly/embletc-96-wad2020

**WATCH THE TALKS BY EDITH AND MATTHIAS HENTZE:**

bit.ly/embly/embites-36-wad2020

**CULTURES**
Although many life science institutes have begun to engage their alumni in recent years, many more are not yet aware of the potential of investing in their alumni communities. The common goal that unites current and former staff puts life science institutes in a stronger position than many universities or large organisations when it comes to building mutually beneficial networks to aid scientific progress. Alumni also play a crucial role as ambassadors for their former institutions, raising their profiles through highlighting impact and fostering collaboration.

To share its experience and explore new opportunities, EMBL has partnered with CASE, the Council for Advancement and Support of Education. CASE are global leaders in the field of advancement (alumni relations, communications, and fundraising). From 8–9 October, EMBL and CASE organised the first summit specifically supporting advancement professionals working in life science institutes.

The summit marked the beginning of a dialogue between colleagues working for various organisations, who were enthusiastic about learning from each other and working together as they build their advancement programmes. In a question-and-answer session the evening before the summit, topics of particular interest to participants included gaining support from senior leadership, starting an alumni engagement programme and establishing a roadmap for its development, effectively building alumni relations online during the coronavirus pandemic, and exploring some of the unique aspects of working in advancement at a life science institute rather than a university.

The summit was chaired by EMBL Director Matthias Hentze and by Bruce Bernstein, Executive Director, Global Engagement at CASE Europe. Sessions were moderated by EMBL staff or other experts and explored ways to deal with the challenges of coordinating alumni networks from a leader’s perspective, as well as how alumni relations, communications, and fundraising can best help to support institutional goals.

Based on feedback from partners and participants, the summit will become an annual event and will be supplemented by additional workshops. While this inaugural summit had a focus on alumni relations, future summits will focus on all advancement fields in support of life science institutes.

Members of the EMBL Alumni Association Board serve as ambassadors for EMBL across its six sites. They develop the Alumni Association’s initiatives, helping EMBL to fulfil its missions and maintain lifelong connections with its alumni community. Erin Tranfield recently joined the board as one of 15 newly elected members.

In 2017, you had a serious accident – how did this change your outlook on life and work?

I think it’s been a humanising process. I fell from a horse and crushed three vertebrae in my spine, spent 40 days in hospital and four months in rehab, and then it took me another year to get back to full-time work. I basically had to learn how to walk again, and I still suffer some paralysis. An experience like this reminds you of what’s important in life. I also have to approach work in a different way now. Some days are inexplicably bad, while others are almost normal, and I’m trying to navigate my way through with as much patience and compassion as possible towards myself and towards others.

How do you approach your new role on the board?

Most of the board members are new – we’re still dating, getting to know each other and everyone’s background and experience. As we go ahead, we’ll learn how EMBL can benefit from our input, how we can support what already exists, and I think there will be opportunities for new initiatives as well. But I’m a fan of doing only a few things at a time. I’m hoping we can pick a few excellent projects first, and once we get those running, we can pick a few more.

What impact do you hope your work for the board will have?

I think the board faces the challenge of making sure that people realise the opportunities that being an active member of the community brings. I think we can support this by advocating for the value of the Alumni Association, encouraging participation, and fostering collaboration. If, at the end of my four years on the board, the alumni community is a little bit more tight-knit and a little more connected, that would be a success.
Working for a healthier world

We’re proud to showcase EMBL alumni whose work is helping to solve current environmental challenges such as pollution, malnutrition, the energy crisis, climate change, and loss of biodiversity. If you’re an EMBL alumni or alumnus carrying out environmental research, please let us know by contacting alumni@embl.org.

Paul Dupree
Professor in Biochemistry, University of Cambridge, UK; Postdoc, EMBL Heidelberg, 1991–1993
I am a plant biochemist and cell biologist, and work on the enzyme machines that make polysaccharides, and how these polysaccharide structures provide remarkable properties to plant cell walls and materials made from them. This has impact in four areas. First, pollution: we work on replacing plastics with biocomposite materials. Second, malnutrition: we work on improving dietary fibre and reducing sugar in food. Third, the energy crisis: the sugars in the polysaccharides can be fermented to transport fuels or biogas. And fourth, climate change: we work on capturing CO² in buildings.

Andrea Herold
Head of Microbiology – White Biotechnology Research, BASF, Germany; PhD student, EMBL Heidelberg, 1999–2003
“Our research department is developing sustainable innovations for the chemical industry. Examples are chemicals based on renewables and produced by microbial fermentation (instead of petroleum-based chemistry) or biologics (microorganisms) and natural-compound-based actives for agricultural use.”

Peter Uetz
Associate Professor, Virginia Commonwealth University, USA; PhD student, EMBL Heidelberg, 1993–1997
“I started the EMBL Reptile Database, alongside Thure Etzold and Ramu Chenna, when I was at EMBL. At the time it was a small side project, but after nearly 25 years of continuous operation it’s taking much of my time now. The Reptile Database provides data for more than 11,000 reptile species (more species than birds) and the reptile taxonomy for projects such as the IUCN Red List of Endangered Species and the Catalogue of Life, but also data for the National Center for Biotechnology Information (NCBI) taxonomy and many others.”

Lara Urban
Alexander von Humboldt Research Fellow, University of Otago, New Zealand; PhD student, EMBL-EBI, 2015–2019
“During my PhD at EMBL-EBI and the University of Cambridge, I applied and developed methodology in the fields of statistical cancer genomics and single-cell genomics. I now combine this expertise in genomics with my background in applied and theoretical ecology to investigate how these approaches can be leveraged together with established population and evolutionary genomics approaches to inform the fielding edge of conservation genomics. My research concentrates on two critically endangered avian species endemic to New Zealand, the takahē and the kākāpō, which were considered extinct. Some exciting initial results are currently allowing us to adjust their management according to individual infectious disease susceptibility. I am also co-founder and -organiser of the UK-based organisation PuntSeq, which employs real-time nanopore sequencing for freshwater monitoring.”

Facing challenges together

With the generous support of its donors, EMBL can face societal challenges and seize new opportunities in the life sciences.

BY JOANA WITKOWSKI, EMBL HEAD OF RESOURCE DEVELOPMENT

These are challenging times – and EMBL is keen to contribute to finding solutions. We know that partnering can often lead to greater impact, and we work together with numerous other research institutions and business partners.

We’re also proud that we can count on many individuals, foundations, and companies that give their time, as well as generous support in the form of donations and as members of the EMBL Advanced Training Centre Corporate Partnership Programme. Working together in this way helps to turn opportunities into potential solutions for pressing societal challenges.

These efforts include giving researchers access to the most advanced microscopy technologies, developing young talent, fostering transatlantic scientific exchange, kindling interest in and deepening understanding of life science research, and bridging the gap between current research and science taught in schools.

In addition to the recent supporters listed below, we would like to thank those who wish to remain anonymous, and the many more who have partnered with us through the years.

- Dr. Sabine Hentze
- HeidelbergCement Group
- Sabine Gora & Alexander Gora
- Dr. Manfred Fuchs
- Dr. John Feldmann
- Dr. Helga Drews
- Dr. Jürgen Drews
- Dr. Manfred Fuchs
- Sabine Gora & Alexander Gora
- HeidelbergCement Group
- Dr. Sabine Hentze & Prof. Dr. Matthias Hentze
- Dr. Dr. Sabine Hentze & Dr. Matthias Hentze
- Dr. Dr. Helga Drews & Dr. Jürgen Drews
- Dr. Manfred Fuchs & Sabine Gora
- HeidelbergCement Group
- Dr. Sabine Hentze & Prof. Dr. Matthias Hentze

- Intermedex GmbH
- Bank Julius Bär Deutschland AG
- Renate Junge & Michael Junge
- Monika Martene Kley & Max Dietrich Kley
- Dr. Martina Kulozik & Prof. Dr. Andreas Kulozik
- Dr. h.c. Manfred Lauenschilder & Angelika Lauenschilder
- Leica Microsystems
- Barbara Mancini & Dr. Benedikt Mancini
- Manfred Lauenschilder-Stiftung
- Merck
- Miltenyi Biotec
- Olympus
- Promega Corporation
- ProMinent GmbH
- Roche Diagnostics Deutschland GmbH
- Dr. Hedwig Runnebaum & Prof. Dr. Dr. Benno Runnebaum
- Sanofi-Aventis Deutschland GmbH
- Sartorius
- Dr. Kornele Schütz-Scheifele & Dr. Bernd Scheifele
- Dr. Manfred Schüßler & SNP Schneider-Neureither & Partner AG
- Dr. Manfred Schüßler
- Sparkasse Heidelberg
- Stillia Technologies
- Thermo Fisher Scientific
- Wolf Liegenschaften GbR
- Zukunft Metroregion Rhein-Neckar e.V.

<table>
<thead>
<tr>
<th>Month</th>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>11–15</td>
<td>Virtual EMBO Practical Course: Drosophila Genetics and Genomics</td>
</tr>
<tr>
<td>February</td>
<td>8–12</td>
<td>Virtual EMBL Course: Deep Learning for Image Analysis</td>
</tr>
<tr>
<td>February</td>
<td>15–19</td>
<td>Virtual EMBL Course: Next Generation Sequencing Bioinformatics</td>
</tr>
<tr>
<td>February</td>
<td>22–26</td>
<td>Virtual EMBL Course: Introduction to Multiomics Data Integration and Visualisation</td>
</tr>
<tr>
<td>March</td>
<td>2–3</td>
<td>Virtual EMBO</td>
</tr>
<tr>
<td>March</td>
<td>17–19</td>
<td>Virtual EMBO</td>
</tr>
<tr>
<td>March</td>
<td>24–26</td>
<td>Virtual EMBL Conference: Visualizing Biological Data (VIZBI 2021)</td>
</tr>
</tbody>
</table>

Upcoming meetings

*19 March*
**Virtual: EMBL Retirees’ Afternoon**

*3 May*
**EMBL in the UK, University of Dundee**

*20–21 May*
**EMBL in Italy, IIT, Genoa**

*16 July*
**EMBL World Alumni Day, virtual and EMBL Heidelberg**

**Virtual: Coffee with EMBL**

11 December