The European Molecular Biology Laboratory Magazine

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EMBL etc.

Dynamics

Synapse Cellular machines on the move

Nucleus How neurons stay stable yet adaptable

Cultures Inside industry – experiences of EMBL alumni

Contents

Nucleus

12
Element of surprise

Studies of radiocarbon are helping EMBL Heidelberg's Kyung-Min Noh shine light on how neurons stay stable yet adaptable.

16
History in the making

EMBL's new archivist Anne-Flore Laloë looks forward to the creation of EMBL's new archive.

22
Dynamic duos

Breathtaking artist-scientist collaborations explore how cells divide.

24
Attack from all sides

Powerful collaboration led by EMBL Hamburg's Matthias Wilmanns brings together specialists from across Europe to study tuberculosis.

28
How to crowdsource a paper

Initiatives led by EMBL Heidelberg's Aidan Budd mobilise communities to generate data and knowledge.

Synapse

5 Cellular networking

6 Best of three worlds

7 Why is a dolphin not a cat?

8 Hidden cell types revealed

9 The battle for iron

10 Beyond sequencing

Cultures

34 Shining light onto the fabric of life

35 Eventful moments

36 Christian Boulin Fellowship

Regulars

37 Pathways
In the prime of life

38 Branches
Science takes centre stage

39 Awards & honours

40 Q&A:
Which analogy best describes your research?

41 Reviews
The Age of Empathy

42 Alumni
Inside industry

47 Locus
San José, Costa Rica

PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

Editorial

Observing the explosion of spring green rolling down the hills and across the fields around EMBL's campuses, it is difficult to think of a more fitting theme for this edition than "dynamics". As biologists push deeper and deeper into the fundamental workings of life, dynamics can be found not only in the interactions of molecules, genes, cells, and organisms, but in those of partnerships, networks, collaborations, and communities that contribute to this understanding. From studies of the social life of genes (page 5), how cellular machines move in relation to one another (page 6), and how neurons stay stable yet adaptable (page 12), to crowdsourcing papers (page 28), alumni connections in industry (page 42), and the construction of EMBL's new archive (page 16), we found examples of change, activity and progress almost everywhere we looked. Zooming in on these dynamics highlights ways people in the EMBL community are thinking and learning about the bigger picture, rather than just its parts. It also provides inspiring examples of innovation, creativity and cross-disciplinary interaction. In these pages we shine a light on just a small part of this ever-changing world.

Adam Gristwood
Editor

Word to remember

Ferroportin

Noun, pronunciation: ˈferəʊ pɔːtɪn

The transport protein for iron that permits the flow of iron from intestinal cells into the bloodstream.

A new approach in the search for therapies against anaemia of chronic disease (page 9).

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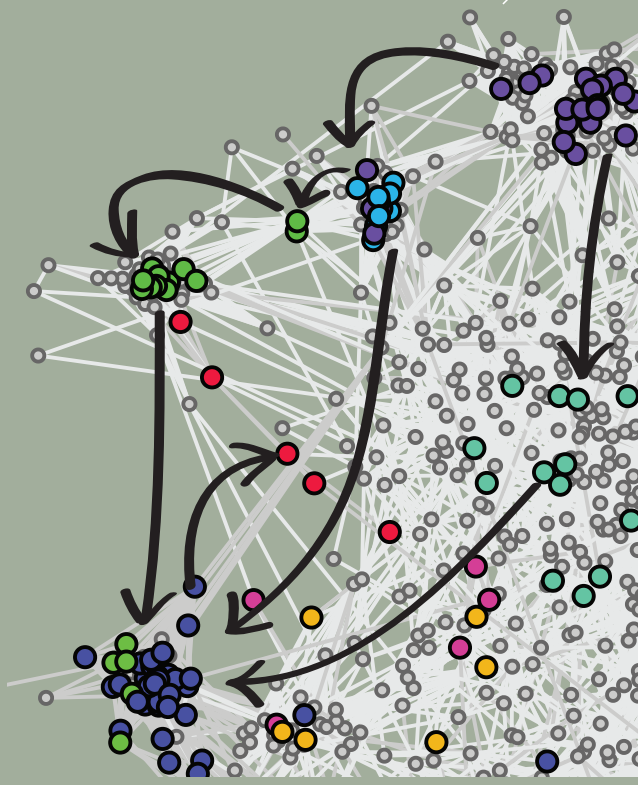
Cellular networking

Genes, like people, are fundamentally social. Just as we often work in teams, companies, or other more or less complex organisations, genes often work together in genetic networks. And just as our productivity is often influenced by who we work with, the effects of genes depend on the peers they interact with.

BY DAN JONES



Genetic interaction network analysis identifies protein complexes and other groups of closely cooperating proteins (coloured dots). Directed interactions of proteins, or whole groups, with each other are shown with the arrows.

IMAGE: EMBL/DKFZ

For the past 100 years geneticists have tried to untangle the complex webs of genetic interactions, and to identify how gene variants affect what other genes do. Ideally, biologists would like a global picture of all genetic interactions in the cell, but this has been hard to track down. Now work led by Michael Boutros of the German Cancer Research Centre (DKFZ), Heidelberg, in collaboration with Wolfgang Huber at EMBL Heidelberg, has shown how it can be done.

The team developed their approach using cells from the fruit fly *Drosophila*. First they selected genes which, when mutated, had an effect on important characteristics like cell growth and division. This generated a list of 1,367 genes, of which 72 were picked out as likely hubs in the genes' social network.

To work out which of these genes – or, more precisely, the proteins they produce – interact, the team set about silencing pairs of genes using a technique called RNA interference (RNAi). The logic behind this approach is that if the effect of silencing both genes at the same time is different from what is expected from the effects of silencing each of them singularly, then that points to a genetic interaction. In these RNAi experiments, each of the 1,367 genes was silenced in combination with one of the 72 key genes – the researchers taking more than a million images and testing almost 100,000 pairwise combinations of silenced genes.

Thirteen per cent (12,361) of the pairs showed evidence of a genetic interaction, indicating that they work together. But Fischer and his co-workers weren't content just knowing which genes interact – they wanted to know how. So they developed a method to work out the direction of genetic interactions – whether gene A influenced gene B, or vice versa. "This is novel, and hasn't been done on this scale before," says Huber. Beyond revealing the direction of the interactions, their analysis also showed whether genes amplified, or diminished, the effects of each other. This way of teasing out the way genes interact across the whole cell could be used to shed light on the genetic interactions in many complex cellular processes, from fruit flies to human cells, to gain a better understanding of genomes and their output and even find new targets for anti-cancer drugs.

"New drugs attempt to exploit lethal genetic interactions to specifically target vulnerabilities in cancer cells," says Boutros. "And genetic interactions may also explain how resistance to cancer drugs arises."

Fischer, B., *et al*. *eLife*, 6 March 2015. DOI: 10.7554/eLife.05464

FULL REPORT ONLINE:
NEWS.EMBL.DE/?p=3646

Best of three worlds

By combining three different kinds of microscopy, scientists at EMBL Heidelberg have been able to determine, for the first time, how cellular machines move in relation to each other as the cell's membrane bends inwards to form a vesicle that carries material into the cell.

BY SONIA FURTADO NEVES

Whether it's a white blood cell engulfing a bacterial invader or a microbe gobbling up supper, cells often take in large items by bending their own membrane around them and folding it inwards, like poking in a finger on a glove. This seemingly mundane process involves around 50 different molecules, and Marko Kaksonen's lab at EMBL Heidelberg is set on untangling just how they do it.

The right track

"It's actually not a cartoon, it's a reconstruction," says Andrea Picco of the animation. "We know the number of molecules, and we know where the centre of mass of the structure they form is. With our approach we can measure and track the movement of those molecules in relation to each other, and we can map that onto the shape of the membrane at each point in time, to really reconstruct how things unfold."

To carry out this reconstruction, Picco, an EMBL interdisciplinary postdoc, combined the best of three worlds. He developed a method which enabled him to track the average positions of the different molecules using conventional light microscopy – "electron microscopy can't follow movement, and super-resolution microscopy is still too slow for this," says Kaksonen. Picco then plotted those molecular paths onto a map of the cell: detailed information on the changes in the shape of the cell membrane as it folds inwards, obtained by electron microscopy. To delve beyond this map of light trails to a more detailed understanding of individual molecules' structure, Picco teamed up with Markus Mund from Jonas Ries' lab, which specialises in super-resolution microscopy. Thanks to this added degree of precision, the scientists discovered, for instance, that a protein called Sla1 (the purple circles in the animation) forms a ring around the tip of the membrane 'finger'.

Understanding function

To the expert eye, this animation also reveals the answer to a puzzle: which direction do actin filaments (the red rod-like elements in the animation) grow in? This has been a debated topic, with different scientists putting forth different possibilities. But by letting the actin network form, then turning off the fluorescent tags on it, and watching where new tags come back on, Picco and Kaksonen were able to show that new actin molecules are added at the base, and the filaments all grow inwards – likely pulling the membrane with them. "We're beginning to go beyond just a description of the structure, to get to the actual function," says Kaksonen. His lab now plans to go further in that direction, by tampering with the different machines and analysing how the whole membrane-bending process is affected.

Picco, A. *et al. eLife,* 12 February 2015. DOI: 10.7554/eLife.04535

SEE ONLINE ANIMATION
NEWS.EMBL.DE/?p=3516

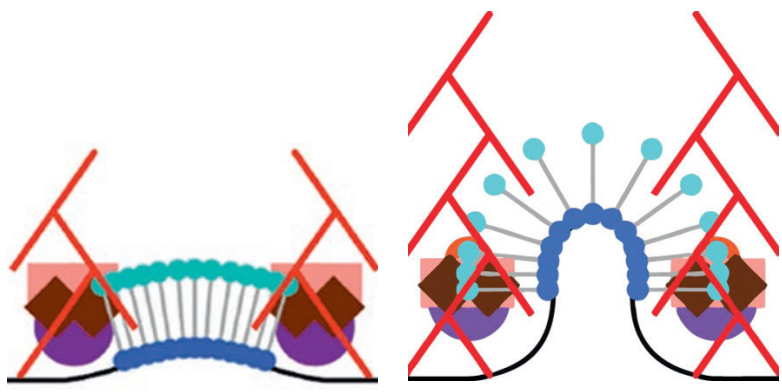


IMAGE: EMBL/A. PICCO

The scientists were able to reconstruct when and where each cellular machine acts as the membrane bends inwards to 'swallow' material from outside the cell.

PHOTO: EMBL-EBI/SPENCER PHILLIPS

Exploring gene regulation in 20 mammals provides insights into the mammalian radiation that occurred over 100 million years ago.

Why is a dolphin not a cat?

New research shows how evolution has given rise to a rich diversity of species by repurposing functional elements shared by all mammals.

BY MARY TODD BERGMAN

Mammals all share a common ancestor, and they share a lot of the same genes. So how did we all start to diverge from one another millions of years ago?

Focus on gene regulation

According to new research from EMBL-EBI and Cancer Research UK (CRUK-CI), published in *Cell*, part of the answer lies in how – and when – genes are regulated. This latest research explores the evolution of gene regulation in 20 mammalian species, and provides insights into the 'mammalian radiation', a time of rapid morphological evolution that occurred shortly after the asteroid impact that caused the extinction of the dinosaurs.

Leveraging findings from a study comparing the genome sequences of 29 mammals, and with the help of conservation organisations such as the UK Cetacean Strandings Investigation Programme and Copenhagen Zoo, the team studied and compared gene regulation in liver cells from 20 key species including the naked mole rat, human, Tasmanian devil and dolphin.

"What we've shown is that evolution repurposes things that exist in all species, to make each species unique," explains Paul Flicek, head of Vertebrate Genomics at EMBL-EBI. "By looking at gene promoters and enhancers in many different mammals, we demonstrated that species-specific enhancers come from ancient DNA – that evolution captures DNA that's been around for a long time, and uses it for gene regulation in specific tissues."

New frontier

Gathering the samples took well over two years, and the experiments themselves produced a staggering volume of data. Analysing the results brought the team to a new frontier in bioinformatics.

"What's exciting about this study is that we now know we can start to answer questions about the functional genetics of many under-explored species – questions we usually can ask only of humans and mice," says Duncan Odom of CRUK-CI. "We can use tools developed to study humans to understand the biology of all kinds of animals, whether they're blackbirds or elephants, and explore their relationship with one another. This research has given us new insights into mammalian evolution, and proven how powerful these methods can be."

Villar, D. *et al. Cell* (in press), published online 29 January 2015.
DOI: 10.1016/j.cell.2015.01.006

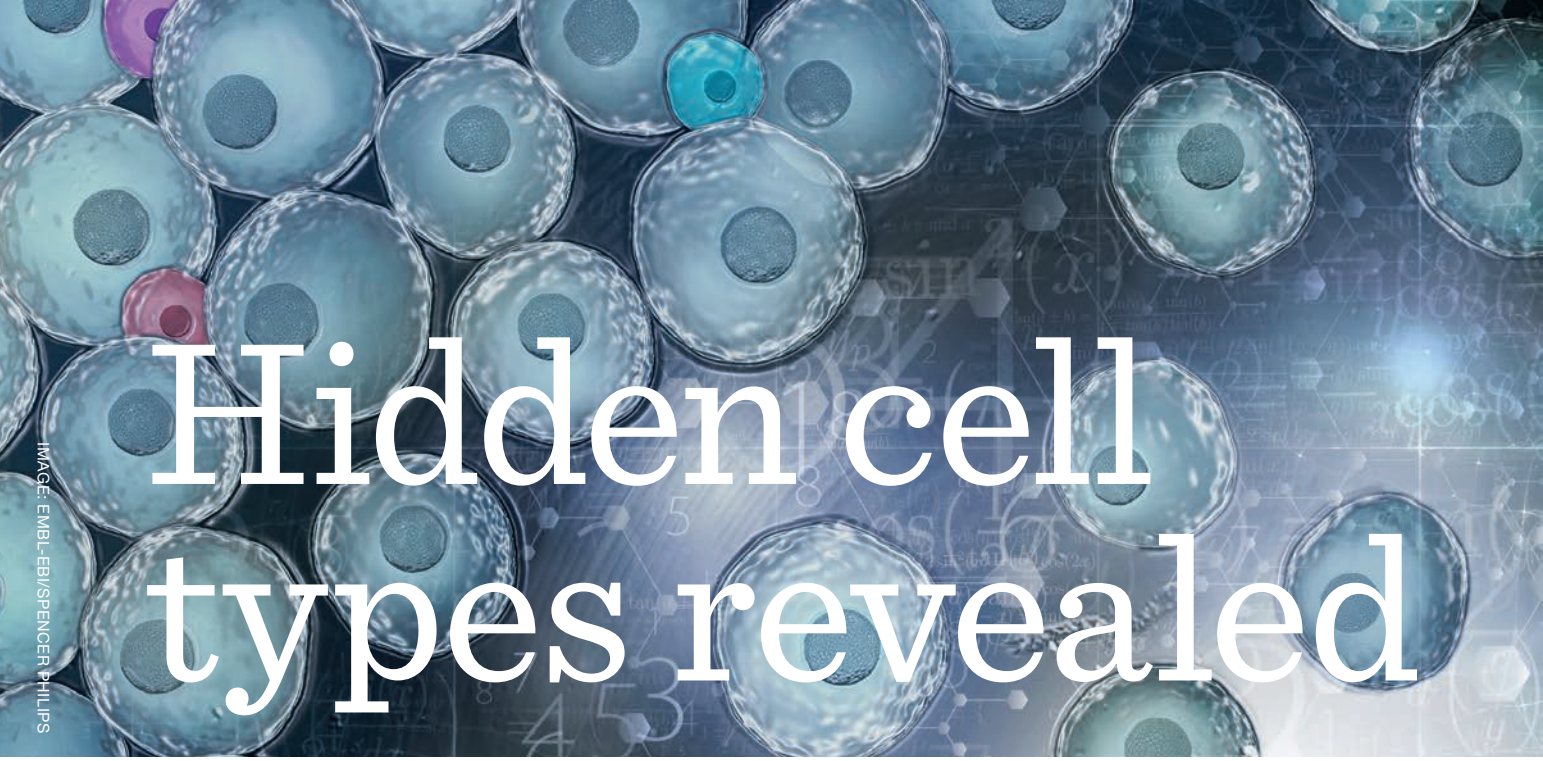


IMAGE: EMBL-EBI/SPENCER PHILIPS

Hidden cell types revealed

The technique helps scientists create a more accurate picture of gene expression in different cell types, and reveals hidden subtypes of cells.

A new method for analysing RNA sequence data allows researchers to identify new subtypes of cells, creating order out of seeming chaos.

BY MARY TODD BERGMAN

Published in *Nature Biotechnology*, the novel technique developed by scientists at EMBL-EBI represents a major step forward for single-cell genomics.

Single-cell RNA-sequencing is a relatively new technology that helps scientists understand how genes are expressed in different types of healthy tissue and in cancers. It provides data on the gene-expression profiles of hundreds of individual cells in a single experiment, producing an exact picture of the individual cell types. However, the fundamental complexity of these profiles has posed a major challenge to making sense of the data.

"With single-cell genomics, we take cells from a tissue and group them into different types based on their expression profile, identifying subtypes that may have a range of functional roles. But to do that properly, we need to deal with confounding factors, and until now we haven't had robust methods for doing that," explains John Marioni, research group leader at EMBL-EBI.

Using single-cell genomics

Take any sample from one type of tissue, some cells will be new and some old – and at any given point in time they will be at different stages of the cell cycle. Most cell types also have hidden sub-types, each of which may have a distinct function. The method allows hidden substructures to be detected and controlled for, which makes it easier to identify relevant biological signals.

"If all you have is gene expression data from single cells, you need a way to identify and correct for the underlying factors that differentiate individual cells, so you can reveal the underlying biology," explains Oliver Stegle, research group leader at EMBL-EBI. "Our model accounts for relatedness between single cells, for example whether they are at the same stage of the cell cycle, identifies potentially confounding variables and removes them. It also makes it easier to find new subtypes – variables you might not have known existed – and correct for them, all in one go."

"The analysis of single cell types is essential for medical research," adds co-author Florian Büttner. "Cancer cells, differentiation processes and the pathogenesis of various diseases can be better explored and understood when they are based only on known, detailed cell profiles. Our model now makes it possible to create such profiles using single-cell genomics."

Buettner, F. *et al. Nature Biotechnology*, published online 19 January 2015. DOI: 10.1038/nbt.3102

The battle for iron

Scientists in Heidelberg have discovered a new approach in the search for therapies against anaemia of chronic disease.

BY SONIA FURTADO NEVES

Our immune system doesn't only launch frontal attacks against microbial invaders: it can also cut off the enemy's supply lines by starving disease-causing microbes of the iron they need to function. However, if sustained for too long, this tactic can cause anaemia, a common problem in chronically ill patients. Research for therapies could take on new directions, as scientists in the Molecular Medicine Partnership Unit of EMBL and Heidelberg University Clinic described a new way through which mice starve pathogens of iron.

Keeping iron inside...

When the body is under attack macrophages, a specific type of white cell that "recycle" the iron from red blood cells into the bloodstream, respond by decreasing their levels of the iron-exporter ferroportin, thereby sequestering the iron. For most patients this goes together with an increased levels of hepcidin, a hormone which regulates iron levels. Claudia Guida, a PhD student in the group jointly led by Matthias Hentze at EMBL Heidelberg and Martina Muckenthaler at Heidelberg University Clinic, found that ferroportin can be dialled down independently of hepcidin, by triggering responses from TLR2 and TLR6, two molecules involved in detecting bacterial components.

"Until now, the main approach to develop treatments for anaemia of chronic disease was to look for anti-hepcidin therapies. Our findings provide an alternative approach to the traditional search for anti-hepcidin therapies," explains Hentze. "It is especially relevant because not all patients with anaemia of chronic disease have increased hepcidin levels."

... and letting it out again

"We don't know why cells have evolved two ways to decrease ferroportin levels, but it seems to indicate that this is an important response," says Muckenthaler, "or it could be that this TLR2/TLR6 response we found is a first line of defense, and then the hepcidin response 'kicks in' later."

Guida, C. *et al. Blood*, 6 February 2015. DOI: 10.1182/blood-2014-08-595256

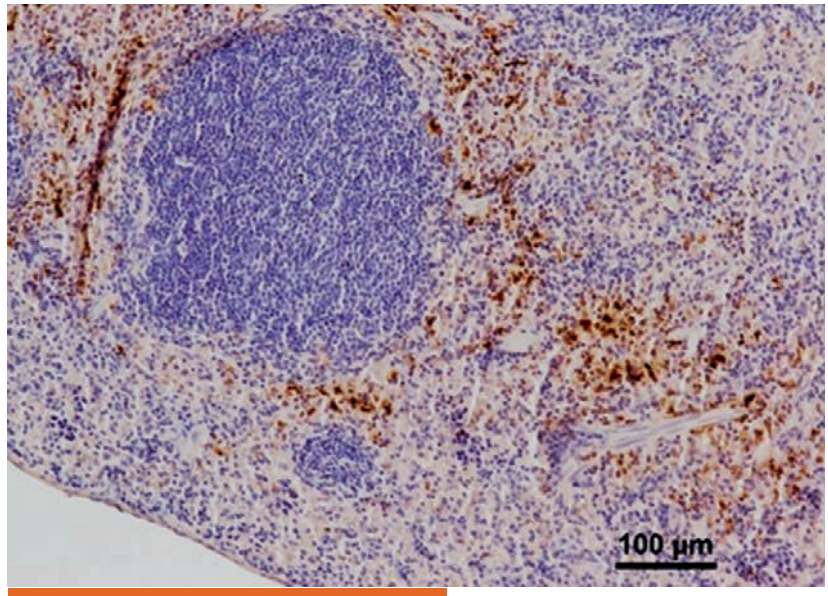


IMAGE: GUIDA *ET AL. BLOOD* 2015

A new way mice keep iron (purple) out of reach of pathogens.

Matthias Hentze discusses how the team discovered this novel iron-sequestering strategy thanks to a screen developed with EMBL alumnus Michael Boutros, now at the German Cancer Research Centre. news.embl.de/?p=3353

Beyond sequencing

Scientists in Heidelberg have looked deeper into subtle links between genes and disease to pinpoint cause and effect.

BY SONIA FURTADO NEVES

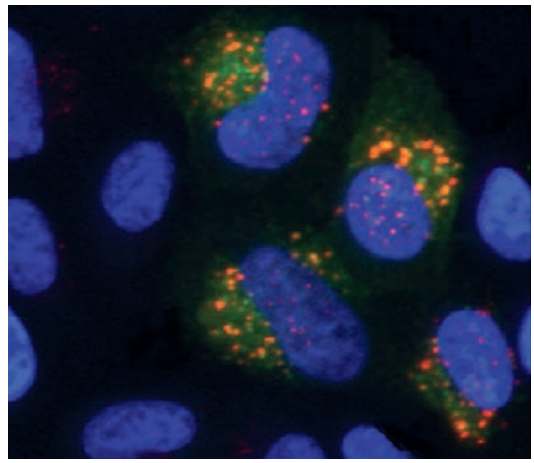
A new microscopy-based approach takes scientists a step beyond gene sequencing studies, enabling them to pinpoint which rare genetic variants cause a disease. The method also allows researchers to draw meaningful conclusions already at smaller sample sizes, which is especially important for rare diseases.

Rainer Pepperkok from EMBL and Heiko Runz from Heidelberg University Clinic – working together through the Molecular Medicine Partnership Unit – teamed up with researchers at the Broad Institute of MIT and Harvard to analyse data from 3000 people in Italy, half of which had suffered heart attacks before the age of 45.

Cholesterol connections

Heart attacks at such a young age are very rare, so these patients are likely to have rare disorders that predispose them to heart disease. The scientists focused on one gene in particular: LDLR, where several mutations have already been linked to familial hypercholesterolemia. But there was no easy way to tell which of those variants really caused the condition. "Without a biochemical test or very clear clinical conviction it can be very difficult to make a diagnosis based on DNA sequence alone," explains Runz.

Cells with a deficient LDLR take up less cholesterol, thus leaving more in the person's blood vessels, and



Bypassing errors

Accurately assessing and estimating errors is a crucial but often undervalued step in any scientific experiment. Scientists from the biological small-angle X-ray scattering (SAXS) group at EMBL Hamburg have now developed an approach to assess how well sets of data fit together, which bypasses the problem of error estimation altogether for SAXS data experimentalists, but also researchers across the physical sciences.

Franke, D. *et al. Nature Methods*, 6 April 2015.
DOI: 10.1038/nmeth.3358

FULL REPORT ONLINE
NEWS.EMBL.DE/?p=3661

Beyond COMPARE

The COMPARE project was launched with more than €20 million in funding from the EU to speed up the detection of and response to infectious disease outbreaks using genome technology. It will create the data infrastructure to support rapid sharing and analyses of data on disease-causing microorganisms from around the world together with other relevant information such as clinical and epidemiological data. Its ultimate goal is to reduce the public-health, patient-specific and economic impacts of epidemics and outbreaks.

FULL REPORT ONLINE
NEWS.EMBL.DE/?p=3094

increasing the risk of heart attacks. The scientists applied their new automated microscopy analysis to see which of the cells from the Italian patients slowed their cholesterol uptake. The upshot: only 14 of the 70 variants found through sequencing had a visible impact on cells' ability to take up cholesterol.

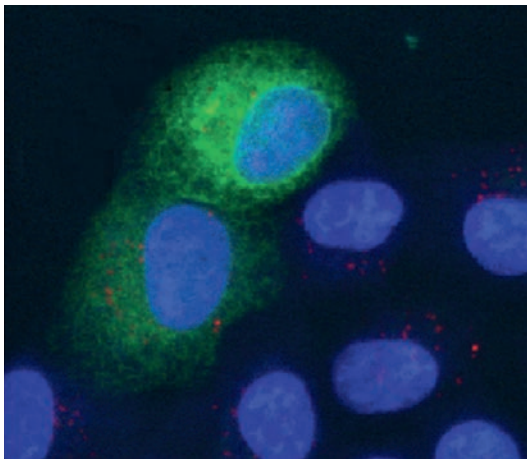
"To some extent, this study is a call for caution," says Pepperkok: "new sequencing technologies are powerful, but we shouldn't overstate the results, because you find so many variants that are just not relevant."

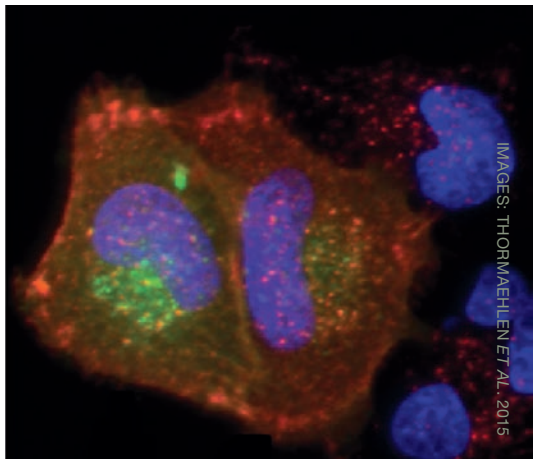
Narrowing the field

The new method is widely applicable and could be used to help untangle the genetics of virtually any condition where an effect on cells can be observed and quantified under the microscope. It could prove very useful to narrow down genetic results from mere associations to verifiable cause-and-effect.

Thormaehlen, A.S. *et al., PLoS Genetics*, 3 February 2015.
DOI: 10.1371/journal.pgen.1004855

FULL REPORT ONLINE
NEWS.EMBL.DE/?p=3341





IMAGES: THORMAEHLEN *ET AL.* 2015

The new method helps identify which mutations to a gene actually cause a disease.

No humans required

Researchers from the Ellenberg group and from the Advanced Light Microscopy Facility teamed up to design a new software that automates a powerful but previously slow technique called fluorescence correlation spectroscopy (FCS). The scientists can now track proteins and the molecules they interact with in living cells more easily and efficiently. Studying such interactions provides important insight into crucial functions, like cell division, but also on what can go wrong in disease.

Wachsmuth, M. *et al.*, *Nature Biotechnology*, 16 March 2015. DOI: 10.1038/NBT.3146

FULL REPORT ONLINE
NEWS.EMBL.DE/?p=3589

Barcoding epigenetics

Scientists in the Steinmetz group at EMBL Heidelberg developed Bar-ChIP, a new method to search for epigenetic markers in many samples at once, thus allowing for much quicker analyses. Applying it to yeast, the EMBL scientists have begun to untangle how having one specific tag may affect whether a histone – one of the proteins DNA is coiled around – receives further tags.

Chabbert, A. *et al.*, *Molecular Systems Biology*, 12 January 2015. DOI 10.15252/msb.20145776

FULL REPORT ONLINE
NEWS.EMBL.DE/?p=3309

Element of surprise

Studies of radiocarbon are helping EMBL researchers shine light on how neurons stay stable yet adaptable.

BY CLAIRE AINSWORTH

On 30 October 1961, a mushroom cloud more than seven times the height of Mount Everest rolled skywards over Novaya Zemlya, an archipelago in the Barents Sea. It was the signature of the Soviet Union's 50 megaton Tsar Bomba, the biggest atomic bomb ever detonated. Its physical shockwave cracked windows 900km away, but its political impact was even greater and helped to trigger an international ban on above-ground nuclear bomb tests. Now, more than half a century later, scientists at EMBL are finding a positive aspect to this dark era of the Cold War: radiocarbon, a harmless component of the fallout from these tests, is providing a window on the workings of the human brain.

Tracing the behaviour of radiocarbon is helping EMBL Heidelberg group leader Kyung-Min Noh and her colleagues in the US to understand how our neurons, the longest-lived cells in our bodies, stay both stable and yet flexible enough to let us learn, remember and think throughout our lives. What's more, they hope the work will provide new insights into brain development defects such as autism, and possibly also other conditions such as Alzheimer's disease.

Radiocarbon records

Carbon is the backbone element of all the biological molecules in our bodies. Almost all the carbon in the world comes in a 'regular' form called carbon-12 that has a particular weight. Radiocarbon is a slightly heavier, mildly radioactive form that occurs naturally in tiny amounts. The above-ground atomic tests pumped a pulse of man-made radiocarbon far in excess of these natural levels into the atmosphere between 1945 and 1963. This made its way into the food chain all over the world, meaning that people who lived through this era incorporated more radiocarbon than normal into their bodies. Once atmospheric levels had dropped back to regular levels, their bodies gradually replaced most of this radiocarbon with regular carbon, as their cells naturally renewed themselves over time.

But different parts of the body renew at different rates, so scientists can work out which cells are replaced and how often by measuring the amount of radiocarbon in the various tissues of people who lived through the atomic-test age. Ten years ago, a team of scientists in Sweden and the US used this technique to show that neurons in some parts of the brain renew themselves throughout life whereas others stop at birth and are as old as the individual to whom they belong. Now Noh and her colleagues have adapted this approach to tackle one of the big mysteries of neurobiology: how do these enduring neurons remain stable yet adaptable?

Unpacking cell secrets

Part of the answer lies in the DNA of the neurons. This DNA contains genes, which instruct the neuron to make tiny molecular machines >>

ILLUSTRATION: AAD GOUDAPPEL

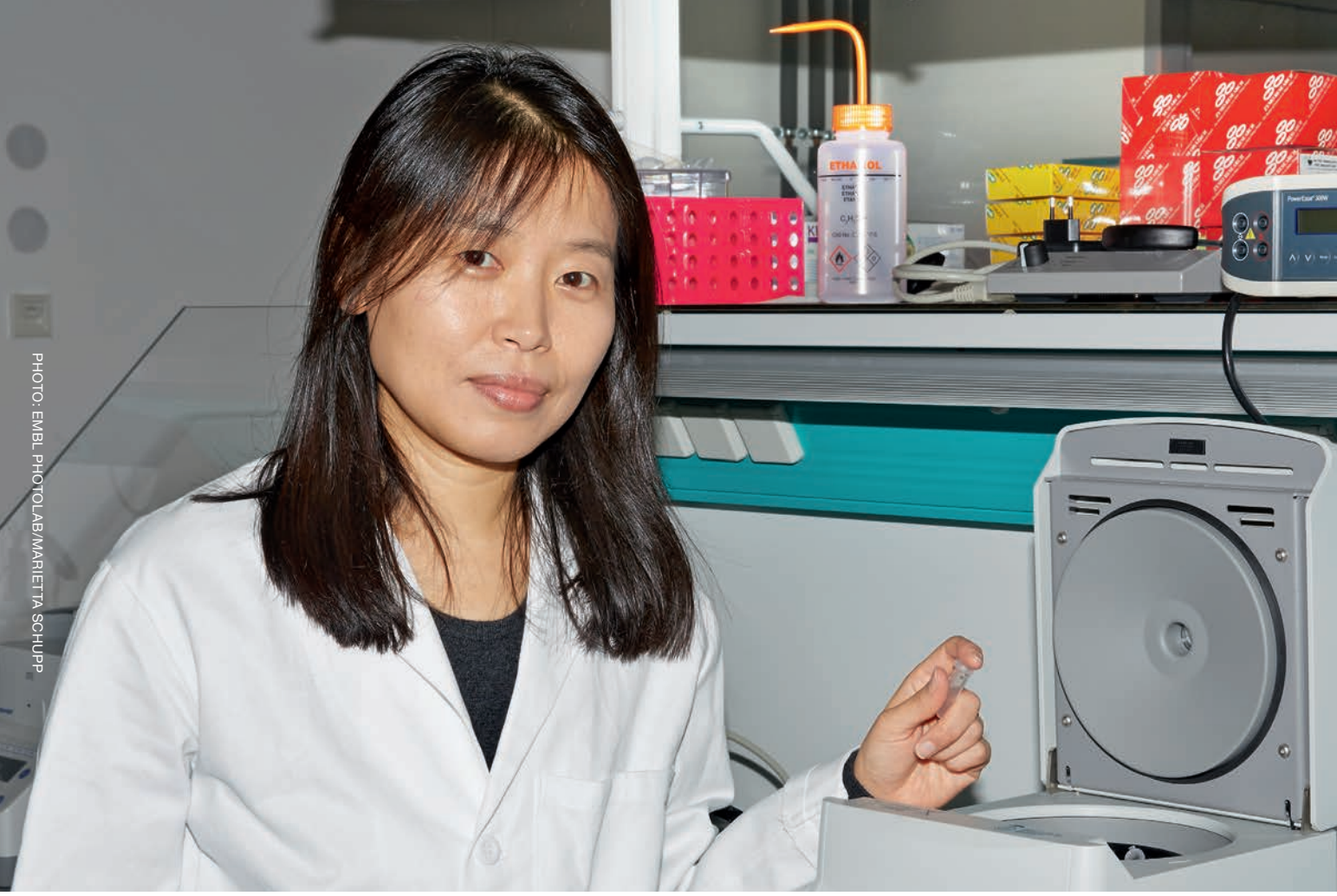


PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

"This opens up big questions: for example, what does this histone replacement during development really mean?"

>> called proteins that enable the neuron to function. Even though almost every cell in our bodies contains the same set of genes, each cell type uses a different subset of these genes to develop its specialist function. This means that the cell needs to keep certain genes active and others inactive.

One way cells do this is by changing the way the DNA is packaged inside cells. Rather than floating around in a tangled mess, DNA is wound around proteins called histones, rather like thread coiled around countless tiny bobbins. Inactive DNA tends to be tightly coiled, whereas DNA containing active genes is more loosely wound and thus more accessible to the cell's gene-reading machinery. A vast army of other proteins tweaks the histones to help regulate gene activity. Noh first became interested in the field of histone biology while pursuing her PhD at the Albert Einstein College of Medicine in New York, US. While studying the effects of stroke in the brains of rats, she found a protein that altered the histones in stroke-damaged neurons. She then began to investigate what was happening to the histones in cells that had permanently stopped dividing, making neurons a logical choice to study. Scientists already knew that actively dividing cells used regular, or 'canonical', histones whereas those that were paused before the next round of division used a different kind, known as 'variant' histones. But they knew very little about what was happening to the histones of cells that had stopped dividing permanently.

Variant histones seem to be associated with active regions of DNA, and so might have a specific

role in regulating gene behaviour. This type of control would be especially important in long-lived neurons, which in addition to surviving a lifetime of wear and tear, also have to alter their gene activity in a highly dynamic way to respond to an ever-changing environment. During her postdoc at the Rockefeller University, Noh and her colleagues discovered that neurons that had ceased dividing did indeed incorporate variant histones into their DNA. But to really understand why, they had to find out when: did the variant histones creep in gradually, or were they added all at once?

Carbon dating

To address this issue in humans, the team turned to radiocarbon. A technique known as accelerator mass spectrometry allowed them to tell the difference between variant histones containing regular carbon and radiocarbon. By studying post-mortem samples from people who lived through the atomic-test age, they found that the incorporation of variant histones seems to take place before puberty. "It's not a gradual process," says Noh. "A very robust replacement occurs during the early phase of human development, and the brain maintains the status quo over the course of the lifetime."

This suggests that histone replacement is a vital step in child brain development, coinciding with when the brain's most dynamic learning processes are taking place, she explains. What's more, recent genetic research has uncovered a raft of gene faults associated with abnormal brain development conditions such as autism and learning difficulties. Many of these genes are involved in histone biology. "These observations open up some very big questions. For example, what does this histone replacement during development really mean?"

Since joining EMBL in November 2014, Noh has been tackling these questions by growing neurons in the lab and performing a range of genetic experiments on them to work out what the histones are doing. This is easier said than done: one of the key challenges in the field of neuron biology is getting enough of the right type of cell to work on. So Noh's team is taking immature cells from mouse embryos and coaxing them to form adult neurons in the lab dish. In addition, they are preparing to work on a kind of cell known as a human iPS cell, which they also intend to turn into neurons. These cells do not come from human embryos but from adult human cells that have been converted back into a more youthful state.

"Resetting a cell back to an ordered healthy state could represent a new therapeutic approach"

Editing effects

To alter the behaviour of the histones in lab-grown neurons, Noh's team is gearing up to use a new technique called CRISPR. This allows scientists to 'edit' the content of genes in the cell by introducing changes into the histones of iPS-derived neurons. These changes, or mutations, will be based on ones known to play a role in human brain development conditions. The iPS studies will allow the team to explore the effects of these mutations on neuron behaviour.

"Although the work is still in its earliest stages, understanding more about neuronal histones could inform research into other conditions, including neurodegenerative diseases such as Alzheimer's disease," says Noh.

Drugs directed at the cellular machinery that alters histones are now being used to treat certain cancers such as T-cell lymphoma, and studies of these drugs are providing new insights into how targeting histones could affect a cell. One emerging idea is that disease can result from DNA not being coiled tidily around its histones. "If you start to untangle all of this disorganised thread, the cell tries to find a way to rearrange it in ordered fashion," says Noh. "Resetting a cell back to an ordered healthy state could represent a new therapeutic approach."

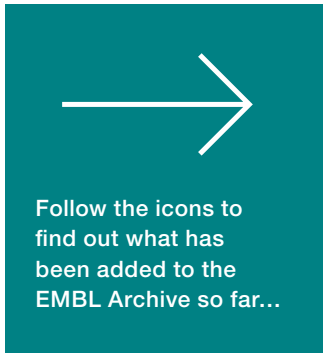
History in the making

Anne-Flore Laloë joined EMBL in January as the Lab's first archivist.

PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

From Albert Einstein's love letters and Marie Curie's scruffy lab notebooks to photos of graffiti scrawled on a wall by Francis Crick, archival material can provide an unparalleled treasure trove for historians to excavate the personal stories hiding behind the science. With the appointment of Anne-Flore Laloë as our first archivist, EMBL can start to chronicle the twists and turns and ups and downs of life at the Lab.

BY ADAM GRISTWOOD



Follow the icons to find out what has been added to the EMBL Archive so far...

Carefully placing a cardboard box down in the middle of an empty room, Anne-Flore Laloë smiles to herself about the small piece of history she has just acquired. The container, home to a large collection of photographs donated by an EMBL alumnus, is one of the first contributions to the Laboratory's new archive – a project to preserve and catalogue material that is often at risk of being forgotten and make it widely accessible. "There was a danger that a century from now we might look back and much of EMBL's history would have been inadvertently lost," says Laloë, who joined EMBL in January this year. "With this project, we are making sure that EMBL's unique past and present is available to scientists, historians, philosophers and more in the future."

Spurred by warnings from the academic community that the history of the molecular life sciences is at risk of vanishing unless active steps are taken to protect it, EMBL's

Photos of the development and evolution of the EMBL sites.

photographs

The construction of EMBL's guesthouse in Boxberg.

PHOTO: EMBL PHOTOLAB

Electrical drawings from EMBL's Core Facilities.

drawings

Alumni Association launched the archive initiative with the aim of safeguarding the Laboratory's heritage. "This idea was really galvanised by EMBL's 40th anniversary," says Laloë. "EMBL has grown rapidly and represents a huge chapter in the history of molecular biology in Europe. Each person who leaves the Laboratory takes away a chunk of our story with them – but you can collect this, be proactive and make sure that your past and present is available for the future.

"Our goal is to collect unpublished, original material in whatever format it exists – letters, photographs, reports, notebooks, memoirs, lab books, memos, emails, article drafts, databases, official documents, you name it – and safeguard it for future generations. Archives take the user on a journey of discovery. You might unearth hidden stories, missing information, or inspirational ideas, as well as learn more about what people were actually thinking, feeling and doing at the time. One of my tasks is to find ways to contextualise the material we gather in connection with other science archives – such as at CERN, the Wellcome Trust, the Medical Research Council Laboratory of Molecular Biology, and many more – that collectively tell the wider narrative of the history of science in Europe. It's an exciting feeling to think much of this awaits documentation and discovery."

Deeper footprints

Cutting through the stereotype of a basement-dwelling academic whose only company is row upon row of dusty boxes, Laloë is outgoing, energetic and excited about her mission. She has already met with alumni and people across all EMBL's sites, raising awareness and gathering ideas for what she describes as a big community project that belongs to everyone who has >>

EMBL memorabilia and artwork from visiting scientists and others who have connected with the Lab.

memorabilia

Photos from staff and alumni of professional and social activities at EMBL.

photographs

"Archived material can have huge social significance, ignite public interest and provide insights into how things really happened."

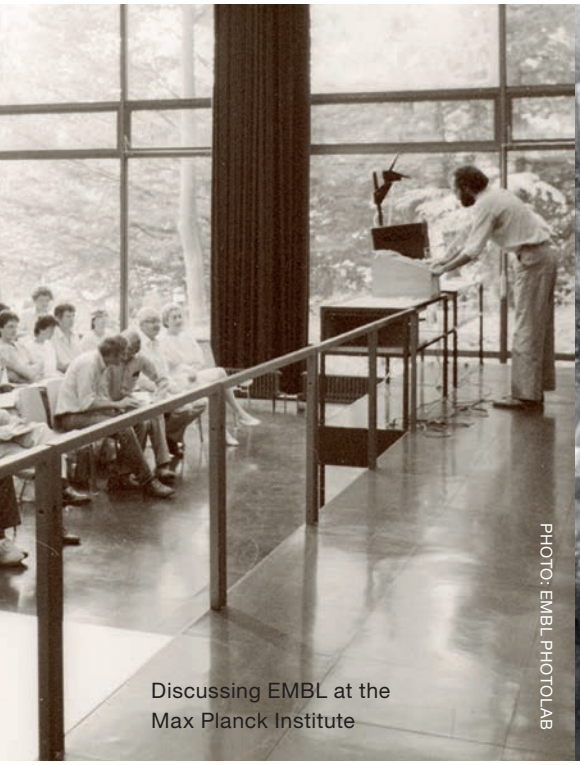
>> been part of the EMBL story. Her take home message for this large numbers of protagonists: "Throw nothing away! At least not before considering what you might have to offer the archive".

"Imagine getting your hands on the original manuscript of a famous song, or an initial sketch of an influential painting – look hard enough and the same thing can be found in science," she says. "Archived material can have huge social significance, ignite public interest and provide insights into how things really happened, enriching our understanding above and beyond the 'official' record. Scholars using the Royal Society archive in the UK, for example, have recently shed new light on the crucial role of women in practising, popularising and communicating science during Victorian times by comparing letters, documents and other rare materials with official literature. It revealed remarkable contributions that add new dimensions to our understanding of science during these times."

Laloë is quick to point out that such insights might come from something as unremarkable as a notebook, an article draft or a quickly scribed email. "We are looking for the ordinary as much as the extraordinary," she explains. "The creativity of people who have access to archives is mind-blowing – seemingly innocuous notes might inspire plays, songs, books and poems – while at the same time this information can deliver important clues in understanding how certain ideas are generated. What changed between the first draft and the published version? How did the thinking evolve along the way? Why did you circle that paragraph with red ink seven times? All of this information is cocooned in everyday material, both analogue and digital."

How can you contribute?

If you feel you have something to offer EMBL's archive, Laloë urges you to get in touch with her as she can offer advice on ways to effectively capture the information, as well as discussing aspects such as access rights and confidentiality. "Sometimes I meet with people and the first thing they will do is look >>



Discussing EMBL at the Max Planck Institute

PHOTO: EMBL PHOTOLAB

Aerial photo of EMBL Heidelberg in the beginning

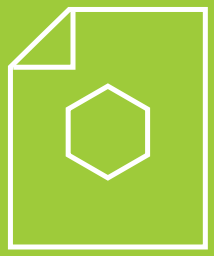
PHOTO: EMBL PHOTOLAB

An annotated copy of a 1997 EMBO Practical Course handbook.

practical course

With good humour, EMBL Director General Iain Mattaj contributes the first item to the archive – a laser pointer that broke when the concept of the archive was launched.

laser pointer



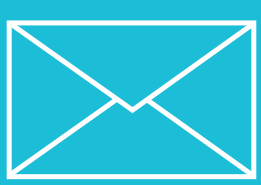
A copy of the original proposal for EMBL from 1967, prepared by the Council of EMBO, including annexes by Francis Crick, Jacques Monod and Hugh Huxley.

proposal for EMBL

>> around their office and say 'as you can see I do not have much here!'" she explains. "But everyone has their own personal archive – it might be a filing cabinet, a box of photographs at the bottom of a cupboard, or document folders on a laptop. These items might seem irrelevant to you, but they could be of significant importance to the collective memory of EMBL. Anything that you donate in confidence will remain so."

The first item to be deposited in the archive came with a certain amount of humour – EMBL Director General Iain Mattaj donated a laser pointer that stopped working during the launch of the concept in 2010. Among the first collections to be processed this year will be those of former Director General Fotis Kafatos and former Head of Core Facilities and Services Christian Boulin, each representing a different facet of EMBL's activities. Other items include a copy of the original proposal for EMBL from 1967, technical illustrations from EMBL's Core Facilities, a box of official and social photographs, and a commemorative flag from EMBL's 40th anniversary celebrations (see icons). But Laloë is on the hunt for much more. "The material that we look after might be frozen in time, but our activities are not," she says. "The archive will be active and modern, continuously growing and evolving. There is a massive resource to be tapped in terms of both material and knowledge – ultimately we want to create a resource that is comprehensive, easy to navigate and accessible to scholars the world over."

One challenge lies in getting people to recognise the value of their material, particularly in the digital



Analogue and email correspondence describing administrative and scientific activities, and providing unique insights into the story of EMBL.

correspondence

Original leaflet featuring the flags of EMBL's 10 founding member states – today, membership has grown to 21 member states, two associate member states and three prospect members.

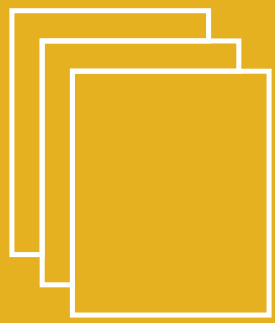
leaflet

EMBL's first Director General, John Kendrew

PHOTO: EMBL PHOTOLAB

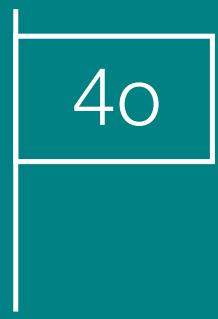
Essential scientific records of the Laboratory's achievements.

lab books



Magazines, annual reports and other communication materials spanning past decades.

communication materials



Commemorative flag flown at EMBL events celebrating EMBL's 40th anniversary.

flag

era when data can be deleted at the touch of a button. "While the medium has changed, the essence of the conversation hasn't – people think that letters were only full of important information, while in fact they could be just as informal as today's emails," she explains. "I once read a letter from a taxonomist to his colleague. He ended the note with a complaint bemoaning the fact that his servant was ill and he was being forced to eat out everyday – poor him! We can learn a lot from these interactions. It's the personal meeting the scientific, and letters of the past are not much different to the email exchanges that we have nowadays."

Creating excitement

Laloë, who holds a PhD in Geography, joined EMBL from the Marine Biological Association of the UK, where she was responsible for the Association's varied historical collections. This included a herbarium, with specimens dating back to the 1800s. "Specimens were often beautifully preserved in albums, the colours as brilliant today as when they were collected. But by teasing out the accompanying letters, we were able to learn more about what life was like for collectors, or where a rare species was first spotted. It is interesting to try and imagine, a century from now, how people will look at the work we are doing today at EMBL, and then be able to understand who did what and why. Whether it is a specimen of seaweed, or a re-jigged machine that enables you to focus on something specific, you give a voice to the person who was there in the first place. It is like a time capsule."

A first practical step is to create the database and begin cataloguing in earnest before the year is out, creating an interface that will make the archive accessible to the world. "Someone might want to know what the first Annual Report of EMBL looked like, learn more about the first Director General, or how the Staff Association was founded," she adds. "Or it might be that a neat sketch from a researcher can be used in a presentation to school children. The success of the project, and the eventual shape that the archive will take is entirely dependent on what people are willing and able to give us. And that's the other side to it: our archive is a resource to get people excited about EMBL and the personal stories that are the essence of scientific life."

Dynamic duos

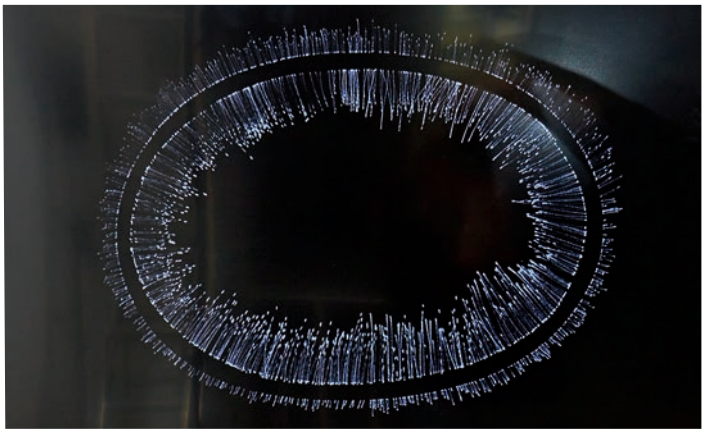
Featuring extraordinary work from four scientist-artist teams, the exhibition Lens on Life explores the fundamental mechanism of human life – mitosis. Currently on display at the University of Heidelberg Museum, the work includes collaboration between artist Robert Kesseler and EMBL alumna Melina Schuh, who did her PhD in Jan Ellenberg's group at EMBL Heidelberg. The travelling exhibition was selected as part of the European FP7 project MitoSys – a large-scale systems biology project aimed at a comprehensive mathematical understanding of how genes and proteins orchestrate mitosis in living cells.

A picture from 'zona pellucida', a series of drawings made following Robert Kesseler's conversations with Melina Schuh, who is this year's John Kendrew Award winner.

PHOTOS: EMBL PHOTOLAB/MARIETTA SCHUPP

Through several visits to the scientific laboratories and the artists' studios, artists and scientists in the project established an open and enduring dialogue.

Robert Kesseler, who is University Chair of Arts Design and Science at Central Saint Martins, also created a glass sculpture of floating coloured lens-like forms.



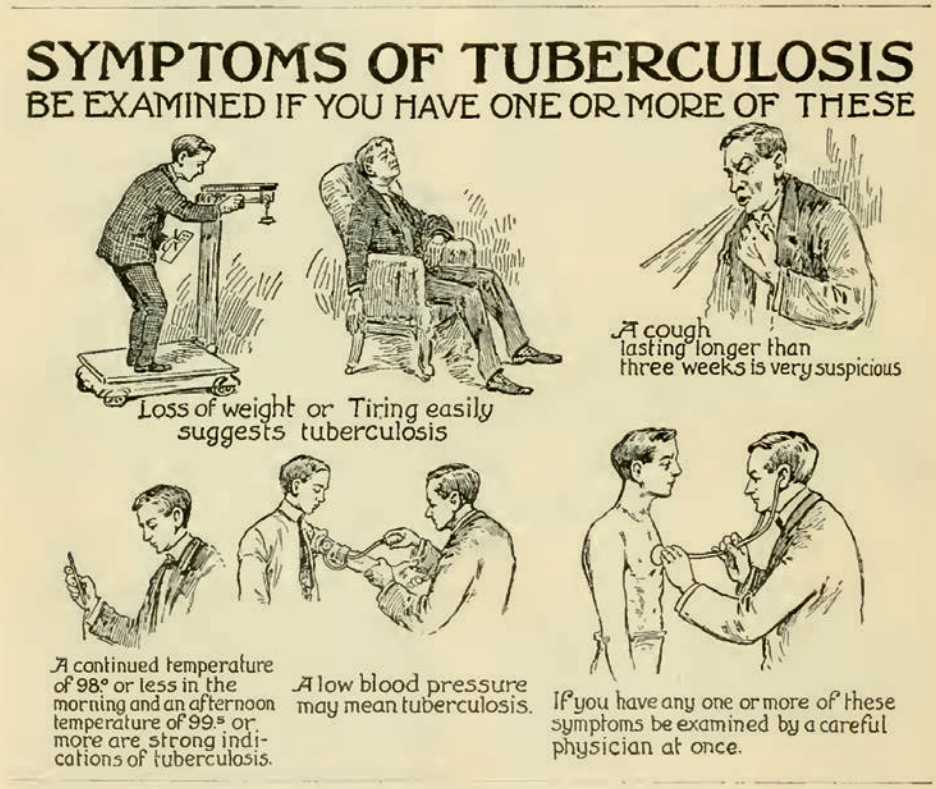
'10 cells' – a piece created by artists Heather Ackroyd and Dan Harvey in dialogue with scientist Jan-Michael Peters.

VIMEO.COM/104119376

Attack from all sides

Tuberculosis – a disease that knows no boundaries, kills millions of people per year worldwide and is developing resistance to current drug therapies at an alarming rate. In order to develop urgently needed new treatment regimes, it is critical to achieve a complete understanding of how *Mycobacterium tuberculosis* (Mtb) – the bacterium that causes the disease – infects, survives and develops. But despite decades of considerable global research efforts, the mechanisms by which Mtb infects and survives in the human body are still largely a mystery.

BY ROSEMARY WILSON



Symptoms of tuberculosis, from a health bulletin issued in 1918.

For such a widespread and complex problem, a multi-disciplinary research approach seems the way to go. A paper published in February in the journal *PLoS Pathogens* by Head of EMBL Hamburg Matthias Wilmanns and collaborators from Switzerland, Poland, and France, illustrates the power of bringing together specialists in different areas.

A global problem

Twenty years ago the World Health Organisation declared Tuberculosis (TB) a global public health emergency. Since then there has been considerable effort to reduce the number of new cases and associated deaths. Although both are decreasing in most parts of the world, TB still remains a major global health concern: in 2013, an estimated nine million people worldwide developed TB and 1.5 million people died from the disease, making it a major cause of death from an infectious disease, second only to HIV/AIDS. The bacterium, Mtb, usually infects the lungs and is spread through the air, for example via coughing or sneezing. Although about one-third of the world's population has come into contact with it, relatively few people will actually develop the disease. Mtb can remain dormant and almost undetected in the human host for years, even decades, before any symptoms develop.

Tuberculosis can be treated effectively with a six-month course of multiple antibiotics. However, in part because of incomplete and foreshortened treatment, cases of 'multidrug-resistant TB' and 'extensively resistant TB' are rising. In such cases, treatment is far less successful, requiring more expensive and toxic drugs over an extended period. In Europe, while the overall number of TB cases is decreasing, the incidence of drug resistant strains has risen significantly since 2005, from 1% to 11% of all cases.

Although it is known that people with a suppressed immune system, such as those with HIV, have a greater risk of developing TB, what exactly triggers the disease to arise from the dormant state is a puzzling and long-standing question. The underlying processes of infection and persistence are still poorly understood despite years of global research activities. The first effective treatment was developed in the 1940s and very few new drugs have been introduced to the market since. As increasing drug resistance bears witness, the need for new, alternative treatments is becoming ever more urgent. >>

"We need to know how it works, and how it works together with other bacterial components."

>>

Complex research

In 2010, TB researchers from across Europe tried a new approach to managing this complex and unusual organism. Thirteen partners, each renowned in their own right for their work on TB, joined forces to set up an interdisciplinary project funded by the European Commission – SysteMTb – with the aim of better understanding the bacterium as a whole, and how it infects humans. One area of research has focused on its unusual cell wall, a thick waxy layer made up of very long lipid chains that protect Mtb from toxic substances, preventing invaders from entering the cell and causing it harm. This structure could also explain why and how the bacterium can remain dormant and undetected for so long. Understanding how this protective layer works and how it could potentially be broken down could pave the way for new drug therapies. Matthias Wilmanns and collaborators focused their efforts on a group of enzymes known as Acyl CoA carboxylases, which are involved in assembling lipids like the ones in Mtb's cell wall.

In Mycobacteria such as Mtb, many enzymes involved in assembling other molecules are themselves not single proteins but large sets of proteins known as complexes. These bacteria appear to have an unusually high number of genes that could code for numerous potential complexes – but the exact composition and function of many of those is not known. "To build up a complete picture of how Mtb's cell walls are made, we need a thorough and systematic analysis of all potential interactions between these proteins," explains Wilmanns. "Mtb is such a complex and unusual organism, we need to collect as much information as possible about how it all works if we are to design effective new drugs. It's not enough to simply know the structure of one enzyme – we need to know how it works, and how it works together with other bacterial components." After identifying potential enzyme complexes, Wilmanns and his coauthors decided to study the AccD1-AccA1 complex – a complex with unknown function.

"Only by approaching such multifaceted problems from all angles, and pooling all our expertise can we get to the bottom of it all."

Unexpected outcomes

Across Europe, a regular exchange of information and samples took place as the groups applied their diverse expertise and approaches to determining the function and biology of the complex. As a first step, Wilmanns' postdoc Matthias Ehebauer, who coordinated the project from Hamburg, asked colleagues at the Polish Academy of Sciences in Warsaw to systematically analyse the interaction patterns of more than a dozen genes. As a result, four Acyl CoA carboxylase complexes were found. They then selected one of these complexes – AccD1-AccA1 – and looked to see if, and what, function was lost when the respective genes were deleted. Genetically engineered Mtb strains were initially sent to the Centre National de la Recherche Scientifique (CNRS) in Toulouse, where scientists compared the lipid composition of the cell wall of the strains with no AccD1-AccA1 with that of 'normal', unmutated Mtb. The results were unexpected: the researchers found no difference in lipid composition.

So, if the complex doesn't build lipids, what does it do? To find out, the group from the Institute of Molecular Systems Biology in Zurich used mass spectrometry to determine what other molecules from Mtb were associated with the enzyme's function. "We found this enzyme is involved in a completely different process," says Wilmanns. In fact, all data collected by the groups show that the enzyme is not involved in assembling lipids at all, but is required for the degradation of an essential amino acid – one of the building blocks used to make proteins, not lipids – called leucine. Arjen Jakobi, an EMBL interdisciplinary postdoctoral fellow working across Wilmanns' lab and Carsten Sachse's group at EMBL Heidelberg, then used electron microscopy to determine the overall architecture of the enzyme. This microscopy analysis showed the enzyme to have a four-layered arrangement, similar to that which had already

been observed in other enzyme complexes known to play a role in amino acid degradation, further verifying the idea that this is indeed AccD1-AccA1's function.

Teamwork triumphs

While the research may not have led directly to the identification of potential drug targets, Wilmanns is keen to highlight that this is an important step towards better understanding Mtb. "As far as we know this is the first demonstration that Mycobacteria have a specific pathway for degrading leucine, so even though this is not the answer we were expecting, it's great to be able to add one more piece to the puzzle. And it will help to find more specific inhibitors against other complexes of this protein group." However, perhaps as important as the results themselves, has been to show how powerful a multidisciplinary and complementary approach has been in the field of tuberculosis research. "Without the work and results from each group, we would not have been able to build up a complete picture of how this enzyme works. This is really the way future research will, and should be done," says Wilmanns. "Only by approaching such multifaceted problems from all angles, and pooling all our expertise can we get to the bottom of it all."

Ehebauer, M. *et al. PLoS Pathogens*, 19 February 2015. DOI: 10.1371/journal.ppat.1004623

Tuberculosis remains a major global health concern: in 2013, an estimated 1.5 million people died from the disease.

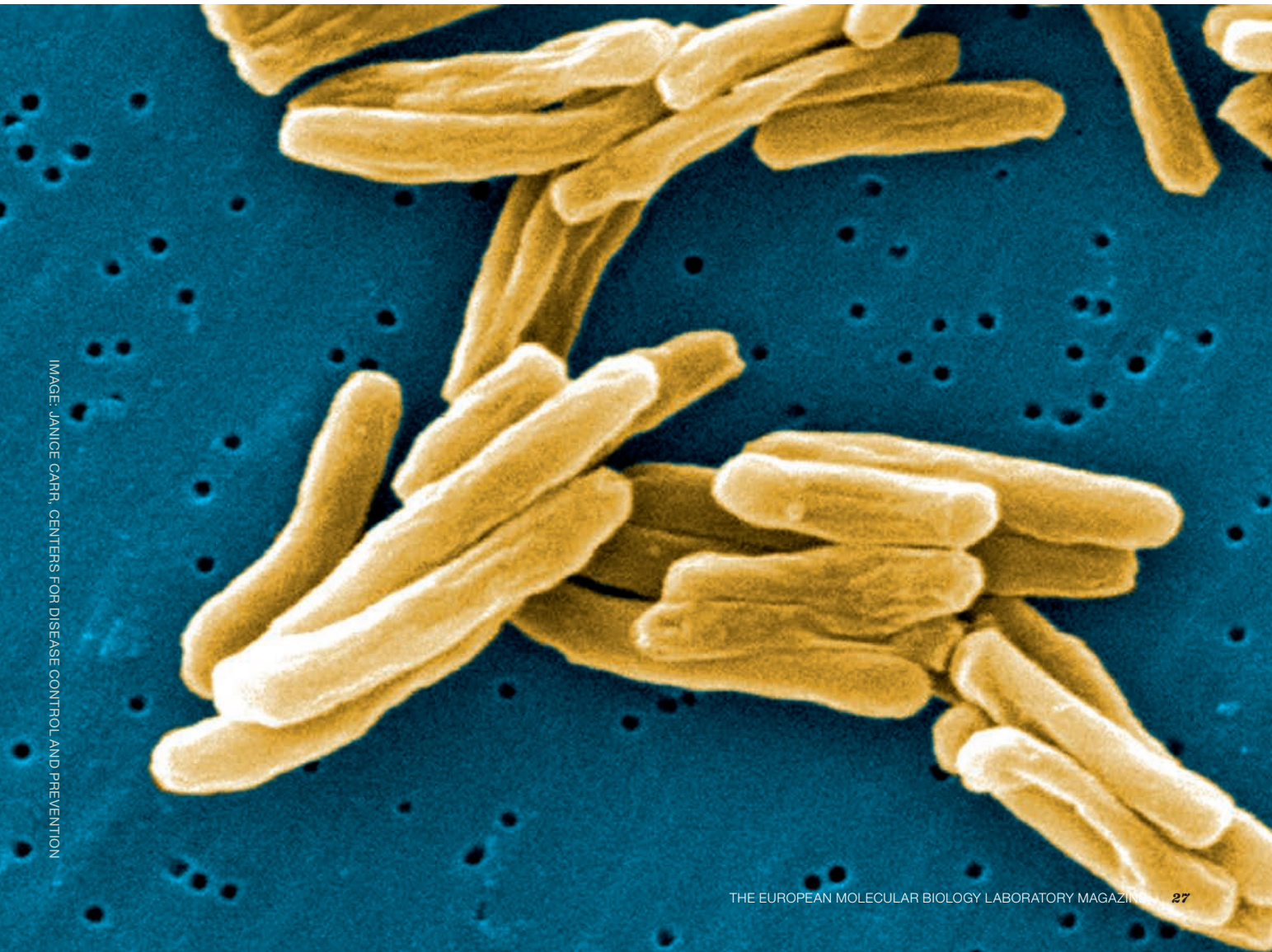


IMAGE: JANICE CARR, CENTERS FOR DISEASE CONTROL AND PREVENTION

How

PHOTO: TOM GRACE

Having taken an unconventional approach to writing his latest scientific articles, Aidan Budd shares tips on what to do – and what to avoid.

BY SONIA FURTADO NEVES

to crowdsource a paper

Aidan Budd has spent a considerable amount of time over the past year spearheading activities that have just culminated in two papers in *PLoS Computational Biology*. This would seem normal for an EMBL scientist – in Budd's case, in the Gibson group at EMBL Heidelberg – were it not for the fact that the resulting papers are not bioinformatics analyses of gene regulation networks or metabolic interactions, but rather tips and rules for building a bioinformatics community and organising an 'unconference'. Another particularity is that in writing the papers, Budd and collaborators took the collaborative nature of science a step further: both papers made use of crowdsourcing.

Whether it is getting video-gamers to help predict the 3D structure of proteins, drawing on people's ability to identify shapes to understand how galaxies form or using a screensaver to search for signs of extraterrestrial life, the idea behind crowdsourcing is to pool resources and contributions from many people to generate data and knowledge.

Budd is keen to encourage others to try employing this approach while writing certain kinds of scientific papers, as it offers an opportunity for more and different voices and opinions to be heard on the topic of the paper, and is, he believes, an extremely effective community-building activity in itself.

Beyond bioinformatics

The two papers just published in *PLoS Computational Biology* brought together people – mainly bioinformaticians, but also science communicators, administrators, and journalists – from three continents, and Budd would like to extend their reach even further. "Even the 'building a bioinformatics community' paper has many tips that could be widely applicable to people other than bioinformaticians; the list of issues it highlights could be helpful for people looking to build lots of different kinds of communities."

Spreading the word

"It's the same with 'unconferences': it's about spreading ideas and things that we've enjoyed a lot and consider have been very successful, and would like to offer other people the opportunity to do the same. It's about letting people know that these things exist, and maybe spiking their interest and giving them the confidence and inspiration to try them themselves. All of that goes beyond bioinformatics. We'd be very happy if people from other areas read the articles and shared their thoughts and experiences. That's part of the reason why we made sure these articles were published open access, so that everyone – bioinformaticians or not, scientists or not – can read them. These articles were group efforts, with lots of effort put in by many people, including current/previous EMBLers Janos Binder, Damien Devos, Holger Dinkel, Konrad Förstner, Adam Gristwood, Pierre Khoueiry, Francis Rowland, Laura Rubinat, and many other contributors."

And if you have – or are planning to – crowdsource a paper, Budd would love to hear from you: via email aidan.budd@embl.de or on twitter @aidanbudd

Budd, A. *et al. PLoS Computational Biology*, 6 February 2015. DOI: 10.1371/journal.pcbi.1003972
Budd, A. *et al. PLoS Computational Biology*, 29 January 2015. DOI: 10.1371/journal.pcbi.1003905

Turn the page for dos and don'ts of crowdsourcing articles. >>

Do

Participants exploring ideas during an "unseminar" – Aidan Budd is a cofounder of the Heidelberg Unseminars in Bioinformatics

>>

Do Check your tone is always respectful

"It's really easy to slip on this – especially in moments of stress or hurry. Amazing people who I know and like can be – without realising it – really quite disrespectful at times, and do things that I think 'ah, I wish they hadn't done that because I expect it'll cause others to be less likely to contribute.' So, remember that the way you talk to people has an impact on their likelihood of wanting to be involved."

Do Commit to open, transparent communication at all times

"If you're open and transparent about what you want, what you want to do, how much time you have, and so on, this builds trust – it makes people more willing to work with you. When that openness is not there, I've only ever seen it cause resentment and frustration. And even though I know this, I catch myself also being non-transparent sometimes. You just go 'oh, I know that person, I'll just ask them if they're happy to do that', because it's quicker at the time. But that carries a huge risk that other people will resent not being asked – so you have to really make a conscious effort. Typically in such situations I've gone 'd'oh! Right, what can I do about this so that I can actually open it to everyone and genuinely give everyone an opportunity?' And that can be difficult at times, not least because it often means giving up things that I want to do. But I accept that, by doing so, I'm helping the community to move forward."

Do Have one person who really owns the project

"Someone who really wants to make it happen and will take responsibility, and at the same time has the confidence to believe that they can make it happen. If you're that person, you have to be comfortable asserting yourself and pushing others and ultimately making decisions. As much as possible you'd like everyone involved to decide with you, and agree with you on the process, but also things need to stop at certain points."

Do Some recon

"It's also useful to contact potential publications in advance to see if they'd be interested in publishing something like what you have in mind – to see if there's any point in doing it, and if so, if they have guidelines you should be aware of."

Do Realise that things have to end at some point

"These papers actually aren't as crowdsourced as I would have liked. I had hoped to open the community article up further by asking people generically on Twitter and other social media, and incorporating those contributions too, but in the end I just couldn't face the large amounts of work and delay that that would bring. At some point, I wanted to get something out there that was useful for people, rather than waiting to make it even more crowdsourced."

Do Consider organising related events

"For the community article we organised a workshop at ISMB/ECCB [the Intelligent Systems for Molecular Biology/European Conference on Computational Biology conference, one of the worlds largest meetings of bioinformaticians] and invited all speakers and organisers of that workshop to contribute to the paper – the more crowdsourced part being that we collected feedback from all 100-plus participants and used this as a resource when writing the article. For the unconference paper, we held a 'birds of a feather' session at ISMB – which groups people together based on shared interests – and invited everyone there to contribute. This kind of thing can help bring new people onboard, including people you might not know beforehand. But perhaps most importantly, organising something like this raises your profile and provides evidence of your dedication to the project and your ability to deliver, which can make people that bit more likely to join. You never know when you're going to meet these people again; I just introduced myself to a new bioinformatician here at EMBL, asking if he'd like to work with us on the Bio-IT project, and he said 'You don't remember me, but I know you; I was at the unconference session in Berlin two years ago.'"

Do Ensure you can get critical mass

"Make sure you have access to reasonably large groups of people who could be interested in getting involved. People are much more likely to get involved in something like this if they know the person who's asking, and it's someone who they think will actually deliver – a generic request from a stranger is much less likely to succeed. And in connection with that, look for people who are hubs of connections with similar interests, and who could know of other contexts or communities to tap into and help mobilise others."

>>

Don't

>>

Don't Underestimate the time and sustained effort required from the lead person

"I've found most people can make a valuable contribution without it taking too much of their time and effort, but you need at least one person – and, ideally, just one person – who makes a considerable amount of effort to make things happen."

Don't Do everything by email

"Actually talk to people. Decisions can be made so much quicker sometimes by discussing in person or at least on Skype – or teleconferences, group chats, whatever – than in endless looping email rounds. You can clear up misunderstandings so much faster, and get a sense of the majority's feeling – and just generally decide together."

Don't Have too high a standard

"There are things I'd change in both articles, but I'm alright with them. Actually, I'm proud of them! For the paper to actually get out, you have to be a non-perfectionist. I often ask the question 'Is there anything in here that is so bad you would not be prepared to put your name to it?' – this is different from 'Is there anything you think should be changed?'. Obviously you want something good, but you can't enter endless cycles of change after change after change. People need to appreciate the power they have to say 'No', and the amount of work and effort and delay that comes from making changes. You want revisions, but not too many: the right number to get something that has enough quality for everyone to be prepared to go with it. Assuming you have smart, clued-in people involved, this level of quality will be high enough for the resulting document to be useful for readers. So, if everyone's prepared to put their name to it, then we're OK. People have studied these things; there's a whole framework for reaching consensus – if you're thinking about doing something like this, read about it."

Don't Crowdsource research papers

"Crowdsourcing is great at bringing diverse, valid input to an article when the resources needed to contribute are low; it's easy for more people to contribute. This makes it good for papers like opinion, training or review articles, which present broad ranges of ideas and opinions on a topic. But when you crowdsource a paper, the whole point is to open it to contributions from many people, and this makes it hard to limit who has access to the text. So crowdsourcing doesn't work well in contexts where the article cannot be safely shared with a large group of people without compromising intellectual property (IP) or scientific precedence, for example. This, combined with the fact that research articles require more resources – experiments take time and money to plan and execute, and so does data analysis – means that they're not suited to crowdsourcing. Having said that, valid, important research articles can be published from data collected via crowdsourcing. This is the basis of 'citizen science' – a topic on which we're trying to crowdsource another article! However in these projects, the resulting articles aren't usually crowdsourced: the scientists designing and controlling the study are typically the paper's authors."

Cultures

38 Branches: Science takes centre stage

40 Q&A: Which analogy best describes your research?

42 Alumni: Inside industry

What's your story?

34 Shining light onto the fabric of life
Teaching the science of protein structure

35 Eventful moments
A look back to the Corporate Partnership Programme's annual corporate event and look forward to this year's EMBO Meeting

36 Christian Boulin Fellowship
EMBL launches new fellowship in memory of one of the Laboratory's longest serving members

37 Pathways: In the prime of life
Using maths to help bridge the gap between the quantitative and life sciences

39 Awards and honours

41 Reviews
The Age of Empathy by Frans De Waal

47 Locus
San José, Costa Rica

Shining light onto the fabric of life

PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

3D model of the influenza neuramindase used during the LearningLAB.

For its first LearningLAB of 2015, EMBL's European Learning Laboratory for the Life Sciences (ELLS) made the science of protein structure crystal clear for a group of 22 science teachers from all over Europe. BY ISABELLE KLING

The two-day event held in Grenoble was set up in partnership with the EU-funded project FluPharm and gave participants a 360° view of how crystallography can deepen our understanding of the relationship between the structure and function of biological molecules, and lead scientists towards innovative treatments against diseases.

Before the course, most participants associated crystallography mainly with the 3D structure of DNA, which is now more than 60 years old – that left a lot of space to elaborate on the modern aspects of the technique and its application in research, with a special focus on the recent discovery of the structure of the flu virus polymerase.

The programme was a mix of hands-on workshops and talks by EMBL scientists. The visiting teachers learned how to grow crystals from lysozyme – a protein contained in chicken egg white – and how to replicate this experiment in the classroom using an experimental kit. They then went on to visit the protein-expression and high-throughput crystallisation facilities at EMBL Grenoble, and the X-ray beamlines operated by EMBL at the European Synchrotron Radiation Facility (ESRF).

Enlightening and inspiring

The course was enriched by presentations by speakers Kanchan Anand, a visiting scientist at EMBL Heidelberg, and Oliver Szolar, CEO of Savira, a startup co-founded by EMBL. They provided participants with solid background information on protein X-ray crystallography and structure-based drug design for the development of next-generation influenza therapeutics, such as those being developed by the FluPharm project. "I really enjoyed giving this presentation," smiles Szolar. "Small start-ups likes Savira owe a lot to science teachers who motivate their pupils to become researchers: this was a nice way to give something back."

The participants were no less enthusiastic, and grateful to gain valuable and practical knowledge they could use in the classrooms. "Beyond the very friendly and curiosity-driven atmosphere, doing a crystallisation experiment on the bench and then observing how it is done in labs was really interesting," explains one of the teachers. "The presentations were also very enlightening and inspiring."

Following the LearningLAB, the teachers were encouraged to build on their newly gained knowledge, and on the existing ELLS teaching resources, to design their own classroom crystallography activities. After some refinement by the ELLS team, these resources can be shared on the ELLS online platform.

EMBLOG.EMBL.DE/ells

Focusing on partnerships

EMBL's corporate partners zoom in on big data and bioimaging.

Members of EMBL's Corporate Partnership Programme (CPP) convened at the EMBL Advanced Training Centre for its annual corporate event in February, which this year focused on big data and bioimaging. In a keynote address to participants, EMBL Director General Iain Mattaj discussed the activities and accomplishments of the Laboratory in its anniversary year, and revealed plans to build on these strengths and successes, including a sneak peek at EMBL's next five-year plan for 2017–2021.

Dinner conversations were sparked by scientific presentations from EMBL scientists, senior and junior: EMBL-EBI Joint Associate Director Ewan Birney and Senior Scientist Detlev Arendt presented their latest research, rounded off by a captivating talk by PhD student Yin Cai, selected to represent EMBL's young, passionate talents. Earlier, EMBL scientists met with representatives of the CPP's founder partners – Leica Microsystems and Olympus – for a lively moderated discussion on big data and its relevance to the life sciences and bio-optic industry.

The programme, now in its sixth year, enables companies to support activities at the Advanced Training Centre, reinforcing EMBL in its mission to provide the best training to scientists the world over. The annual meeting, when EMBL leadership and scientists join Partners for networking and discussion, is part of a range of initiatives to acknowledge and reward the generous support of CPP members, and facilitate mutually beneficial interactions between industry and EMBL.

Iain Mattaj welcomes guests in a keynote address

PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

WHAT DRAWS EMBL ALUMNI TO INDUSTRY? FIND OUT ON PAGE 42.

Science to the fore

A look forward to this year's EMBO Meeting in Birmingham.

With talks ranging from nuclear architecture, to defense against pathogens, and stem cell biology, the 6th EMBO Meeting will take place at the ICC in Birmingham, England, on 5-8 September 2015. This year's meeting includes 20 concurrent sessions that take a comprehensive look at biology from the perspective of molecules, cells, the organism as well as the very latest methods that researchers use to study the life sciences.

"The *EMBO Meeting* is a fantastic opportunity to learn about the latest developments in the life sciences across a broad range of topics," says Gillian Griffiths, Professor at the Cambridge Institute for Medical Research and an organiser and chair of this year's meeting. "The scientific scope of the meeting is deliberately broad. We want to encourage scientists to look beyond their own fields, engage with the international scientific community and explore interdisciplinary approaches to research in the life sciences."

The conference – which is expected to attract more than 1000 participants – will include talks from more than 50 scientists from around the world, including several EMBL scientists and alumni. "Europe has such a diverse and innovative science base: I am really looking forward to talking to both old friends and meeting new people from many different disciplines," adds Ewan Birney, Joint Associate Director of EMBL-EBI, who will be speaking at this year's meeting.

PHOTO: EMBL PHOTOLAB

Christian Boulin Fellowship

In memory of one of the Laboratory's longest-serving members, and honouring 38 years of commitment and contribution to the infrastructure of European life science, EMBL has launched the new Christian Boulin Fellowship. BY CHLOË CROSS

Established in memory of Christian Boulin, Director of Core Facilities and Services, the Fellowships support travel and accommodation costs of young scientists visiting EMBL's Core Facilities. Applicants from EMBL's member states with a demonstrable need for financial assistance are encouraged to apply for one of 15 annual fellowships of up to 1500 Euro.

In April 2014, EMBL lost a remarkable colleague, collaborator, advisor and friend. Christian Boulin was not only an accomplished scientist, but also a tenacious and energetic facilitator, who demonstrated an unselfish commitment to EMBL and its goals. "Christian's open-mindedness and intellectual curiosity were at the heart of many successful collaborations," says Iain Mattaj, EMBL Director General. "Under his leadership the Core Facilities developed into what they are today. We're proud to keep his memory alive through this Fellowship programme."

The Core Facilities are one of EMBL's highlights, playing a crucial role in enabling hundreds of scientists per year to achieve ambitious research goals in a cost effective way. Under Christian's direction these central facilities opened their doors in 1998, hosting state-of-the-art equipment and providing expert services and support to EMBL's researchers, visitors and collaborators from the Laboratory's member states. EMBL currently operates a variety of Core Facilities that support multiple research areas pursued throughout the Laboratory.

Building bridges

Each facility has tight links to industries that provide cutting-edge technologies. Christian worked tirelessly to build trusting relationships with many companies, and to identify and establish complementary activities, from advanced training to technology transfer. The Fellowships will build further bridges between industry and facility users, and are made possible thanks to the generous support of EMBL's Corporate Partnership Programme. "This is doubly fitting," says Matthias Hentze, EMBL Director, "Not only did Christian initiate and inspire countless fruitful interactions with our Corporate Partners, but the Fellowships are also a logical extension of the Partners' commitment to nurturing scientific excellence by alleviating financial barriers."

Facilitating success

The Fellowships are intended to defray expenses incurred by scientists visiting EMBL's Core Facilities to learn and use the latest scientific techniques and thus advance ambitious research projects. Applicants must demonstrate financial need, and priority will be given to those from member countries that require scientific strengthening. "Alongside the formal criteria, at the end of the day the most important measure is scientific excellence," says Head of Core Facilities Rainer Pepperkok, who will administer and evaluate applications. "Christian was dedicated to welcoming users and facilitating their success – this is the perfect way to honour his memory."

WWW.EMBL.ORG/boulin-fellowship

Pathways In the prime of life

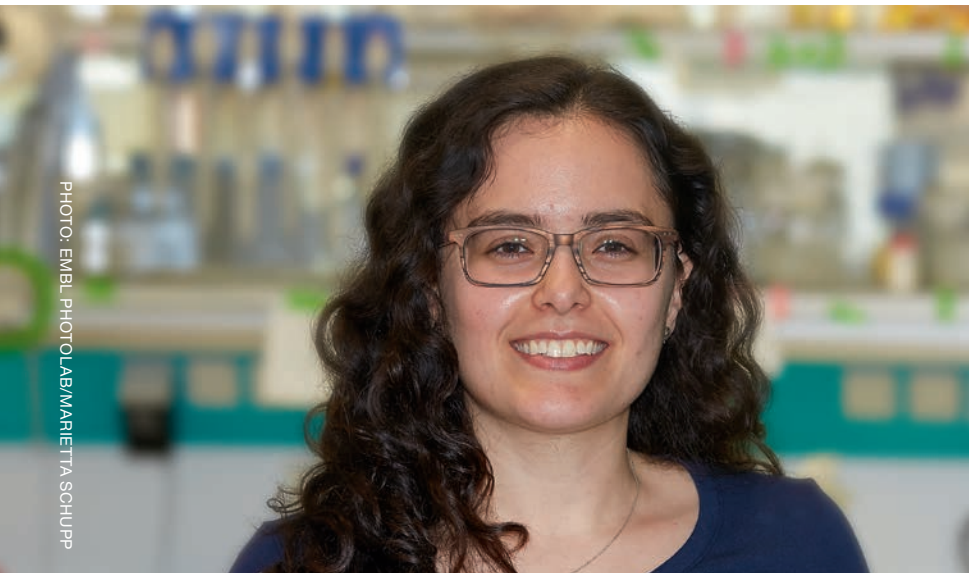


PHOTO: EMBL PHOTOLAB/MARIETTA SCHUPP

Karin Sasaki is not your average mathematician, but then hers is not your average job – she is helping to bridge the gap between the quantitative and life sciences at EMBL.

BY CHLOË CROSS

Dentistry was Karin Sasaki's familial calling: "My mother, my grandmother, even my aunt are dentists," she reveals. But Sasaki chose not to take the path most trodden, and instead turned to mathematics: "At school I didn't think I was clever – maths was one of the hardest subjects, and studying it was a personal challenge." Although mathematics became her tool, biology was her passion, and the fates collided when Sasaki was invited to take an undergraduate mathematical biology project forward with a PhD at Imperial College, London. She continued her research into mathematical modelling of DNA with a postdoc at the Institut des Hautes Études Scientifiques (IHES), Paris. For anyone hoping to follow in her footsteps, Sasaki advises: "Be enchanted by biology, but have mathematics as your secret weapon."

Now, Sasaki is putting her "secret weapon" to work within EMBL's Centre for Biological Modelling, one of four internal centres that provide expertise, advice and training for scientists across the Laboratory to promote and facilitate interdisciplinary research. "My job – under the guidance of François Nédélec, Kiran Patil, and Julio Saez-Rodriguez – is to direct the integration and widespread adoption of mathematical and physical modelling into everyday research at EMBL," she explains. Day-to-day, her tasks can vary from consultancy to community building, and everything in between: performing collaborative modelling tasks, training EMBL staff in relevant programming languages and software tools, and fostering interactions between EMBL researchers through seminars, journal clubs and interdisciplinary retreats.

Sasaki's priority is to enable EMBL scientists to adopt more theoretical approaches as part of their research. "It's impossible to collaborate with everyone," she says, "So it's better if I support them in gaining the skills and understanding they need to apply these approaches themselves." Finding and guiding researchers in the right mathematical method for their topic keeps Sasaki's days varied: "One day I will be helping to model the morphogenesis of developing embryos, and the next to study the cytoskeleton: completely different projects requiring different approaches. I rely on the experts, on the people in the labs, to advance my understanding more quickly."

"Be enchanted by biology, but have mathematics as your secret weapon."

Sasaki wields her "secret weapon" with an infectious enthusiasm and honesty: "Ask questions, no matter how stupid you think you look – being red for five minutes, avoids you being green for days," she says. "Applied theoreticians are in a middle ground," she concludes, "You are not proving new ground by breaking theorems in mathematics, and you are also not an expert in biology. Learn to feel comfortable in that situation, and know that 'translation' is key to interdisciplinary research."

Branches Science takes centre

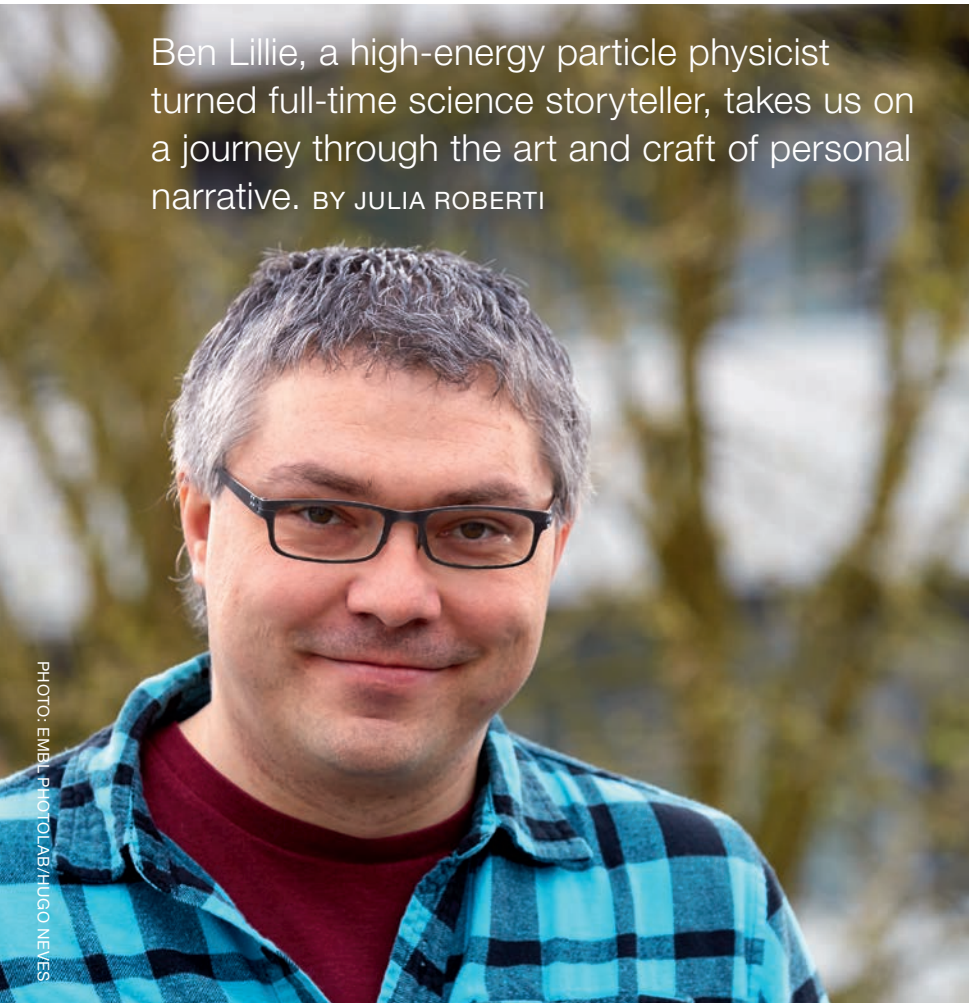


PHOTO: EMBL PHOTOLAB/HUGO NEVES

Ben Lillie, a high-energy particle physicist turned full-time science storyteller, takes us on a journey through the art and craft of personal narrative. BY JULIA ROBERTI

Ben Lillie gave a talk entitled "Crafting stories about science" on March 30, as part of the EMBL Science and Society Forum Lectures.

Telling stories is an ancient art. And just as modern day research begins to unravel the mechanisms underlying how our brain reacts when it is fed a narrative, the use of storytelling within the world of science is also undergoing a remarkable renaissance.

"Storytelling is a way of presenting science and reaching audiences outside the limits of a conventional lecture", explains Ben Lillie, co-founder and director of the Story Collider – a storytelling project that provides platforms for scientists and people affected by science to recount compelling, funny or even life changing experiences in theatres, concert venues, bars and online. "I am fascinated by the human side of science. What role does it play in our lives? How does it affect who we are? People love to hear stories, so a personal narrative is the natural way to bring those stories out." Together with his team, he organises a continuing tour of compelling stories – those taking to the stage have included a neuroscientist whose inspirational father fell ill with the disease he specialised in, an anatomist struggling between her love for animals and their use in research, and a film editor and musician whose life was transformed after working on a Hubble documentary, just to name a few.

"Fundamentally, there is not any difference between science stories and any other stories."

An emotional journey

Personal narrative goes beyond the goal of getting across a concept and rather carries the listener along an emotional journey – but this does not necessarily prevent science from being well explained. "If one embeds science in the narrative, it will stick in the people's minds, so you have to be careful to avoid distortions," says Lillie. And this means planning well in advance: "We begin preparing at least a month before a live performance – prepping speakers for the nature of cabaret-style performance. They do not read from a script: the story needs to sink

stage

in and appear unrehearsed – so that it comes out with a feeling of 'here is what happened', mobilising the tremendous energy that comes from telling a personal narrative," he says.

Beginning, middle, end

Drawing inspiration from his particle physics background, Lillie explains that very little "activation energy" is needed to craft your own story, and can be achieved following some basic ground rules. "It is useful to identify an "emotional arc" – either starting at a low point and ending on a high, or vice versa and then using this structure to manage the pace as the events in the story unfold," he says. "Fundamentally, there is not any difference between science stories and any other stories – they need a beginning, a middle and an end –, and most importantly the story needs to matter to the person telling it. Take opportunities

"If one embeds science in the narrative, it will stick in people's minds."

to practice: write out the whole talk, then throw that away and distil it down to an outline. One may want to explain all the science behind an event, but if it is not needed to advance the plot, leave it unexplained: often it is better to launch straight into the action. Find your emotion, be natural, and once the exciting part is over, stop there – the tension releases and at this point the narrative pays off."

STORYCOLLIDER.ORG

Jan Korbel (centre left) received this year's Chica & Heinz Schaller Research Award, together with Brian Luke (centre right).

Awards & Honours

Rolf Apweiler, Joint Associate Director of EMBL-EBI, has been elected as a Fellow of the International Society of Computational Biology (ISCB) in recognition of his many contributions to the field. Fellow status is conferred to ISCB members that have distinguished themselves through outstanding contributions to the fields of computational biology and bioinformatics. Apweiler will be among eight new fellows introduced and profiled at this year's ISMB Meeting in July.

Recognised for his scientific achievements applying microscopy in the field of cell biology, group leader and senior scientist **John Briggs** has been awarded a Royal Microscopical Society medal. The medals celebrate individuals who make outstanding contributions to microscopy across the life and physical sciences. Briggs will receive the Medal for Life Sciences and give a lecture at the Microscience Microscopy Congress this July.

Alongside Brian Luke from Heidelberg University's Centre for Molecular Biology (ZMBH), **Jan Korbel** received the Chica & Heinz Schaller Research Award in February. The 100 000 Euro award is granted annually for outstanding, innovative, work in the field of biomedical research, and is the main funding instrument of the CHS Foundation. In May, Korbel will jointly receive the Martin-Fuchs-Prize, awarded with Fruzsina Molnár-Gábor of the Max Planck Institute for Comparative Public Law and International Law. The award from the Heidelberg Academy of Sciences and Humanities is bestowed for the first time this year, and presented in recognition of the pair's recent bioethical studies in the context of patient genome sequencing.

Dame Janet Thornton, Director of EMBL-EBI, has been elected to the Scientific Council of the European Research Council (ERC). The Scientific Council – the ERC's governing body – defines the scientific funding strategy and methodologies, acting on behalf of the scientific community in Europe to promote creativity and innovative research. Thornton joins 18 eminent scientists and scholars, who are appointed by the European Commission on the recommendations of an independent committee.

Q&A Which analogy best describes your research?

Different types of glass

How can the 3D structure of a protein give us information about its function? Think about something simple that we all use every day: a glass. We all know what it is and its function: drinking liquids. But a closer look in your cupboards will probably reveal many varieties and forms: some are for water, tea, wine or beer. Zoom in even further and you can differentiate their function even more: glasses for white or a red wine, for wheat beer or Pilsner. So looking at a protein structure on a molecular level can give you a snapshot of the important features that distinguish its function. Further down the line it can help scientists design drugs.

Daniel Passon, postdoc, EMBL Hamburg

Domino effect

My research project focuses on a specific part of how the immune system works. Schematically, when a threat gets into the body, it is first detected – that is the job of receptors –, then it sets off a domino chain of reactions that end by triggering the actual immune response to destroy the threat. I am looking into how the detection triggers the domino chain. Imagine that the domino chain is ready but you need a metal one, that is divided into pieces scattered across the chain to start it. Then what the receptor needs to do is to switch on a magnet that will attract all the metal pieces to it, and rebuild the first domino to spark the chain-reaction.

Paola Kuri, PhD student, EMBL Heidelberg

Postal parcels

Cells are not self-sufficient: they feed from their environment. But they don't have a mouth, so how does that work? Cells make parcels – called vesicles – containing food or information – molecules. Like postal parcels, vesicles are made of a protective layer on the outside, and carry items to several destinations. Cells use their outside membrane to create the protective layer of the parcel. Molecules that need to go in are taken into dimples that get bigger until the molecule is totally wrapped in it, and finally separates from the membrane. These dimples are covered in a second protective layer made of a molecule called clathrin. We study how this extra layer of clathrin forms, so we can understand better the fundamental communication of cells with their environment, and maybe get inspiration from clathrin scaffolds to build nanomachines in the cells.

Ori Avinoam, postdoc, EMBL Heidelberg

PHOTOS: EMBL PHOTOLAB

Review The Age of Empathy

The Age of Empathy: Nature's Lessons for a Kinder Society (2009), Frans De Waal

BY HALLDÓR STEFÁNSSON

Frans de Waal's *The Age of Empathy* is directed mostly at a non-scientifically trained readership, and it seems to be written with a fairly explicit agenda in mind: If people can be persuaded that they are by nature cooperative, then they will surely act more kindly towards others in their community and hopefully to people from other cultures as well.

In striving to reach a popular audience, de Waal relies heavily on narrative anecdotes about animal and human behaviour to illustrate the points he wishes to communicate. *The Age of Empathy* contains accounts of bonobo behaviour he has personally witnessed, as well as stories from other scientists about the animals with which they spend their professional lives. Arguably, these enchanting descriptions of individual elephants, dolphins, ravens and chimpanzees may be more effective in convincing non-specialists readers of humankind's innate moral sense than dry and drawn-out descriptions of repeatable experiments.

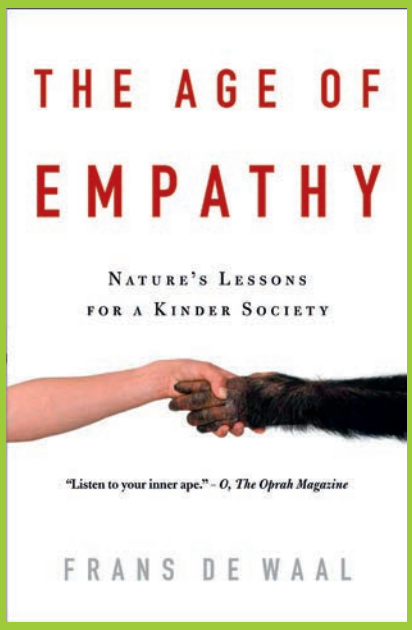
Emotions are contagious

The biological argument at the heart of de Waal's *The Age of Empathy* is that empathy itself is 'multi-layered' (p. 209). At a basic level, he suggests that our compassionate core relies on our capacity to match the emotional state of other beings. Because of this ability, emotions are contagious; fear, for example, can spread instantly in a crowd, even when people are preoccupied with only their own safety. Overlaid on this are more complex tendencies, including feelings of concern for others, and finally our ability to feel our way into the perspectives of another individual. Frans de Waal wants us to believe that we are not selfish at our core and only decide to act kindly toward others; we automatically do so unless we are taught otherwise.

More of everything

But what we qualify as *empathy* should not be confounded with some form of essence that defines us in absolute terms as a species. Humans may have a greater capacity than primates for empathy, but "it's just inconceivable that perspective-taking and self-awareness evolved in a single jump in a few species without any stepping-stones in other animals" (p. 139). Similarly, he argues that the differences between the cooperative behaviours in humans and primates, like the bonobos he studies, are differences in degree, not in kind. What distinguishes us from other animals, then, is that we have more of everything – "more empathy, and more self-awareness" (p. 139).

Some of the inspiration for writing this book must have come from exasperation with the mentality of the neo-liberal market economy so pervasive during the first decade of this century. For *Homo Economicus,* the self-image it expounded, "greed was good", greed and selfishness were the basic drivers of our constitution; they should be cultivated and cherished. One cannot but wish that de Waal were right about a natural form of empathy emerging in our encounters with others in our environment. Now, in midst of widespread social hardship inflicted by the failure of the global market economy we will certainly fare better nurturing a more benign, generous view of what makes us tick.



"One cannot but wish that de Waal were right about a natural form of empathy."

Alumni

Industry relations

Basic research is a major contributor to innovation, and in this issue we focus on examples of such innovation. EMBL's global network of alumni, who have gone on to senior positions in pharmaceutical companies, highlight how fundamental discovery and technological progress can lead to products, processes and services that have a real impact on lives and livelihoods. In the coming issues, alumni from other sectors of industry share their stories. Stay tuned for these as well as news on alumni events with a strong industry component – beginning in Switzerland in the autumn.

Mehrnoosh Rayner
Head of Alumni Relations

PHOTO: EMBL PHOTOLAB

Innovation in vaccine development

Riccardo Cortese, former head of the Genome Biology Unit, talks about the Ebola vaccine candidate developed by his start-up, and reflects on his successful career in research and industry. BY STEFANO DE RENZIS

The Ebola vaccine – currently being tested – is based on your work with Okairos, what is special about it?

Traditional vaccines "train" the B lymphocytes into recognising deactivated parts of the pathogen, so they can destroy it more effectively should the body be infected. Unfortunately, this does not always ensure effective protection. I founded the start-up Okairos in 2007 to develop new genetic vaccines, which trigger both T- and B-lymphocyte activation. We started working on the Ebola virus well before the last outbreak in West Africa because it was one of the most dangerous and untreatable pathogens: succeeding with it would be a fantastic proof of concept for our technology.

Unlike the human adenoviruses which are rapidly inactivated by our immune system – we have all been exposed to adenoviral infection –, those of chimpanzees are not recognised by our immune system and trigger a strong response, both from the T- and the B-lymphocytes. We therefore used chimpanzee's adenoviruses as "Trojan horses" in which we inserted Ebola specific proteins. We proved the efficacy of our T-cell based vaccines in these animal models, and sold Okairos to GlaxoSmithKline (GSK) so it could be further developed. Now our Ebola vaccine is in a phase III clinical trial involving 30,000 individuals.

What made you move from academia to the private sector?

I sailed from academia to industry and then biotech: each move driven by restlessness, curiosity and a lot of optimism. I've always felt curious about my research topics, obviously, but also about how I could apply

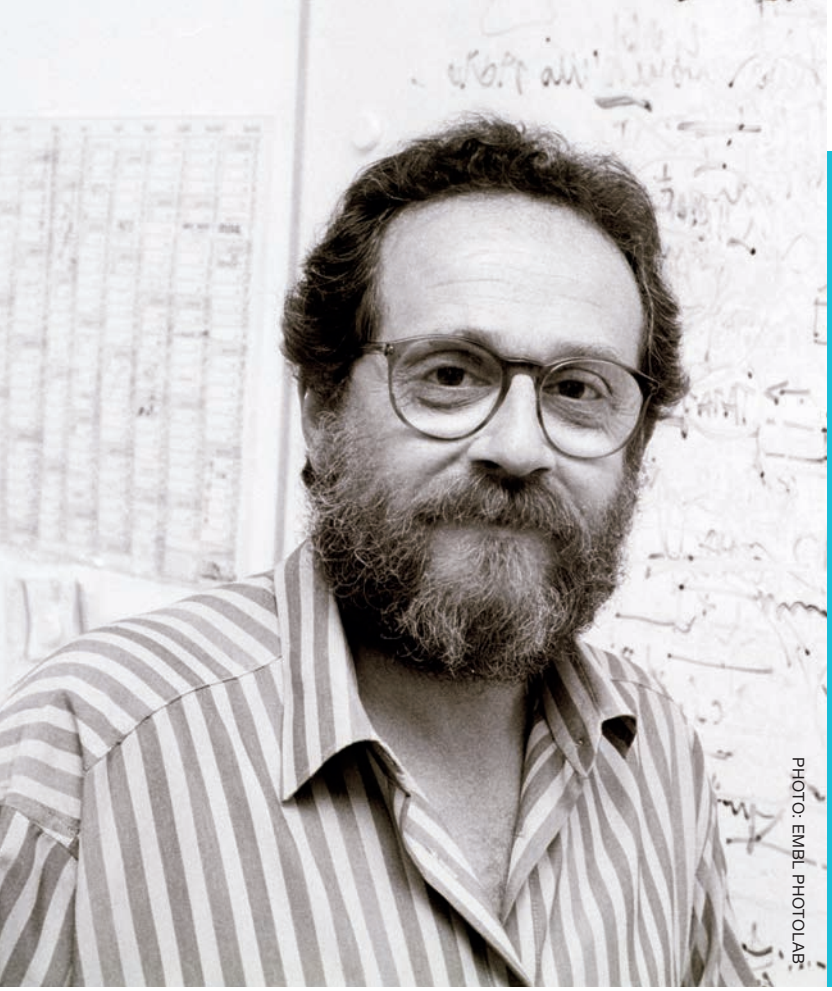


PHOTO: EMBL PHOTOLAB

Inside industry

More than one in ten EMBL alumni successfully make the transition from academia to roles in industry, predominantly in pharma and biotech. Here, alumni in senior positions at the companies attracting the largest numbers of alumni share with us why they made the move, the challenges and highlights facing them, and EMBL's continuing role in their career.

them, maybe a consequence of my medical training... All of these steps were a jump into the dark.

After EMBL, I directed the Integrated Research Biotech Model (IRBM) in Rome where we developed several drugs that are now on the market. This was a great job, so leaving it to start something new like Okairos was risky, but also extremely exciting. In ancient Greek, Okairos stands for "right timing" and I felt that it was the right time for me to do it. Now, I am again in a position to start a new company, this time dedicated to new level vectors to provide a cure for diseases such as cancer.

You've had a very diverse and fulfilling career, what advice would you give young EMBLers?

In 1981 I founded the Gene Expression Programme (now the Genome Biology Unit) at EMBL, so I was able to develop managerial skills in addition to my scientific expertise. This combination proved very successful during my career. EMBL in general has a very strong reputation – which goes far in industry – and offers many opportunities to its scientists and students. I would advise all EMBLers to make the most of this while working in such an inspiring and invigorating environment.

What is your fondest memory of your time at EMBL?

I fitted well into the EMBL culture as a convert and proponent of the "European mission", so it was an interesting and intense time for me. I attracted a lot of Italians: we were all in the same corridor, which apparently had the permanent aroma of espresso. The team spirit was very strong: we even trained together at my home to win the prestigious EMBL beer competition against the British and the Germans!

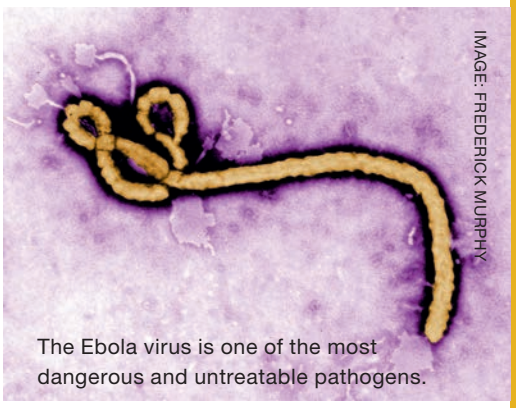


IMAGE: FREDERICK MURPHY

The Ebola virus is one of the most dangerous and untreatable pathogens.

EMBL's ties to industry comprise the 20-year-old EMBL-EBI Industry Programme, technology-transfer at EMBLEM, the Corporate Partnership Programme, Core Facilities and Services, and countless collaborations between researchers at EMBL and companies throughout the world.

Cancer research connections

Norbert Kraut

Now: Vice President Oncology Research, Boehringer Ingelheim, Vienna, Austria
At EMBL: 1990-1994, predoctoral fellow, Graf Group, Developmental Biology


PHOTO: BOEHRINGER INGELHEIM

My PhD at EMBL focused on an oncoprotein that causes leukemia. The work, which was done with Thomas Graf, exposed me to a highly creative incubator in which a series of key discoveries on oncogene activation and collaboration have been made.

I moved to industry after having received an attractive offer to build a functional genomics team at Boehringer Ingelheim in Austria, with the mission to identify novel therapeutic concepts. I knew EMBL alumni who enjoyed working there, and accepted the offer. Later, I had the opportunity to focus again on cancer research and made key contributions in the discovery and development of new cancer drugs. As the therapeutic area head, I am now responsible for the entire company's oncology research efforts.

Boehringer Ingelheim has evolved rapidly, from having no presence in oncology to a franchise with more than 10 compounds in clinical development. We target cancer cells in various ways based on cancer genome analyses, and have significantly increased our efforts on immune cell-directed approaches. Highlights include the recent launch events for our two lung cancer drugs – Afatinib and Nintedanib. The most rewarding feeling is the personal feedback from patients whose lives have changed based on a drug discovered by our research teams.

Current challenges include how we prioritise targets, develop drugs against "undruggable" oncoproteins, best restore tumour suppressor pathways, and identify highly effective drug combinations. To this end, connections with groups in academia are crucial. Work done by Thomas Graf and Hartmut Beug at EMBL in the eighties, for instance, helped in providing the foundation for Afatinib.

We are convinced that major advances and bringing forward new therapeutic concepts can only be made if academic and company investigators team up for equal partnerships. Boehringer Ingelheim is a partner of both the EMBL-EBI Industry Programme as well as the EMBL Corporate Partnership Programme. Already, we have a long and impressive list of successful collaborations which have impacted our drug discovery initiatives, and we want to further explore this with current and former EMBL scientists.

My advice to EMBLers is: Enjoy your time at EMBL, find something you are passionate about, explore new scientific territories and build up a network to help advance your scientific career.

Where our alumni go

- 71% academia
- 13% industry
- 10% government and other
- 6% retired, unknown and elsewhere

Where our alumni in industry are

- 32% Germany
- 13% USA
- 12% UK
- 8% Switzerland
- 6% France
- 4% Italy
- 3% Belgium
- 3% Sweden
- 19% elsewhere

Launching new vaccines

PHOTO: JOHN TELFORD

John Telford

Now: Head Microbial Molecular Biology, GlaxoSmithKline (formerly Novartis Vaccines & Diagnostics), Siena, Italy
At EMBL: 1979-1985, research technician, Pirrotta Group, Developmental Biology

I joined EMBL in 1979 in a technical position. The focus of our group was understanding gene regulation during *Drosophila* development. This was a fascinating period for me and made a huge difference to the way I approached biology. In fact, the work formed an important part of my PhD thesis from the University of Zurich.

I was recruited to industry by EMBL alumna Marialuisa Melli (Lulla) – attracted by the quality and projects of her group, as well as the possibility that our science could impact people's health.

During the past thirty years at Novartis Vaccines in Italy, I have progressed from group leader to project leader and finally head of department of Microbial Molecular Biology, the focus of my group having mainly been vaccine antigen identification and characterisation. Very recently, Novartis Vaccines was taken over by GlaxoSmithKline (GSK), but our goals – the development of innovative vaccines – have not changed.

A highlight of the past year has been our involvement in research that led to the launch of a new vaccine against disease caused by serogroup B meningococcus, a life-threatening illness that is caused by bacteria that infect the bloodstream and lining that surrounds the brain and spinal chord. We have also contributed to the discovery of other vaccines that are now in clinical development. There are several EMBL alumni and three EMBO Members in our research centre and we collaborate with many more – industry can offer attractive careers in research to well trained scientists.

One striking memory I have of EMBL is working in the lab next door to Christiane Nüsslein-Volhard and Eric Wieschaus during the period they did the experiments that led to their Nobel Prize. Another, apart from the science, is finding the woman who has been my wife now for thirty-four years – Tatiana Baldari who is an EMBL alumna and now EMBO Member. And of course there were the parties...

Platforms for proteomics

PHOTO: EMBL PHOTOLAB

Gitte Neubauer

Now: Head of Cellzome a GSK company, Heidelberg, Germany
At EMBL: 1994-2000, predoctoral fellow, Mann group, postdoc and company foundation, Wilm group, Instrumentation

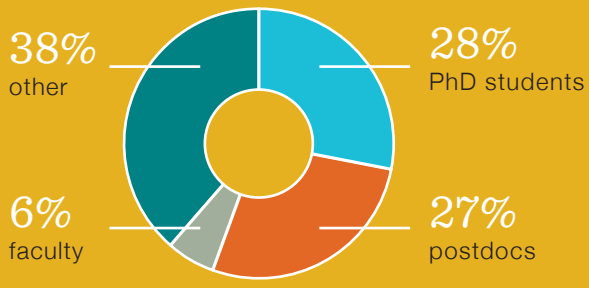
I did my PhD in proteomics at EMBL just when the field was beginning to establish itself. I learnt not only about proteomics, but also how much fun it is to work with so many excellent scientists – the diversity in skills and nationalities makes a very creative working environment!

We founded Cellzome as an EMBL spin-off company to apply proteomics technologies to drug discovery, using all aspects of what we had learnt – from proteomics to hiring the best people no matter where they come from. I moved to industry because I was attracted by the thought of making something so useful that somebody would actually pay for it. Founding Cellzome offered a fantastic combination of great science and commercial impact, plus the opportunity to build and shape an organisation from scratch. Today, Cellzome employs around 60 scientists and is fully embedded in GSK's R&D organisation impacting drug discovery across many indications. >>

>> Cellzome uses its (chemo-) proteomics platform to understand how drugs work on a molecular level for the discovery and development of safe and efficacious drugs. We collaborate with research groups and the excellent Core Facilities at EMBL mostly around novel technologies to study biology and drug action. We bring substantial drug discovery knowledge and associated platforms to the table, which synergise very well with those at EMBL. We regularly publish our science – on several occasions in collaboration with EMBL. Interestingly, I recently met an EMBL alumna at a different GSK site, who is now an important partner for us within GSK.

The highlights for me are the team we have at Cellzome, the science we do and its impact on developing new drugs, and what it takes to bring a new medicine to patients – the complexity of which is also the biggest challenge. My tip to young people at EMBL is to enjoy the science and the time you have to fully immerse in it – don't leave out the parties and be assured that cool science can also be done in industry!

Positions held at EMBL
(by EMBL alumni in industry)



From molecular dynamics to drug development

Marianne Uteng

Now: Group Leader, Novartis, Switzerland (currently on maternity leave with an 8-week old baby)
EMBL: 2002-2008, predoctoral fellow, Surrey Group, Cell Biology and Biophysics


PHOTO: MARIANNE UTENG

I did my PhD in cell biology at EMBL, using fluorescence microscopy to investigate the dynamics of a molecular motor protein in the mitotic spindle. This extensive use of microscopy and the innovations in science and technology played an important role in gaining my first position at Novartis.

I came to industry because I wanted to work at the interface of science and business, and contribute to the development of innovative, applied products that have a direct impact on human health. In this context, pharma is particularly attractive for me as it's a highly complex business, which offers a myriad of life-long learning opportunities.

The goal of Novartis is to develop products that can prevent and cure diseases, while the focus of my department is to identify and characterise drug toxicities and to establish qualitative and quantitative risks of exposure in humans. One of the great challenges is how to accelerate drug development time without increasing expenses, unethical animal use, or compromising safety and quality.

From an industry point of view, EMBL is attractive to companies like ours for its top-notch scientific expertise and training and education programmes. Novartis itself collaborates with both industry and academic partners, and offers pre- and postdoctoral programmes too. I have found this very rewarding and have hosted students in our lab, with plans for more in the future. I also welcome more opportunities to exchange knowledge and ideas with the science community.

My fondest memories of EMBL include the exceptional inter-disciplinary and friendly work atmosphere, lifelong friendships and the great parties. My advice to EMBLers is to choose between an industry or academic career path as early as possible, ideally soon after a PhD – this gives you time to learn more about the culture and dynamics of the workplace.

PHOTO: MAIA SEGURA-WANG

Locus Costa Rica

Central America is this edition's destination as Maia Segura-Wang, a PhD student at EMBL Heidelberg, takes us in and around her hometown of San José, Costa Rica.

Costa Rica is famous also for its multiple active and dormant volcanoes. Arenal Volcano, my favourite, is one of the most iconic ones due to its conical shape built after successive eruptions of lava, ash and rocks.

Due to its geographic location, Costa Rica is characterised by tropical landscapes and a huge range of beautiful biodiversity.

PHOTOS: THOMAS ZICHNER

I love the amazing range of opportunities to practice adventure sports, such as water rafting or canopy tours above the rainforests.

Away from San José, lands are mainly used for agriculture and as areas of pasture. However, sometimes tourists and locals are in for a surprise: cattle often escape their farms and wander along the streets.

Events

June
3

The Cambridge Union Society
Pandemic! An EMBL Science and Society event at the Cambridge Union explores the global threat of deadly diseases.

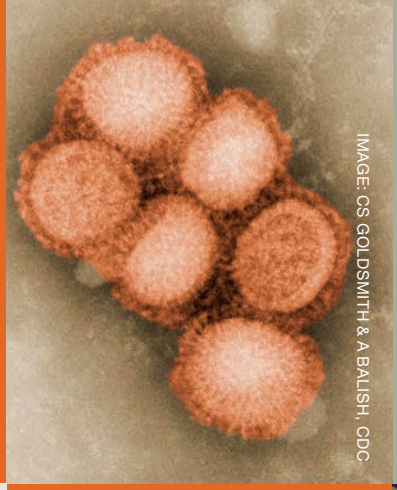


IMAGE: CS GOLDSMITH & A BALISH, CDC

June
4

EMBL Monterotondo
Science and Society seminar: Artificial life and the origins of life – Martin M. Hanczyc, Centre for Integrative Biology, Università degli Studi di Trento

June
4-5

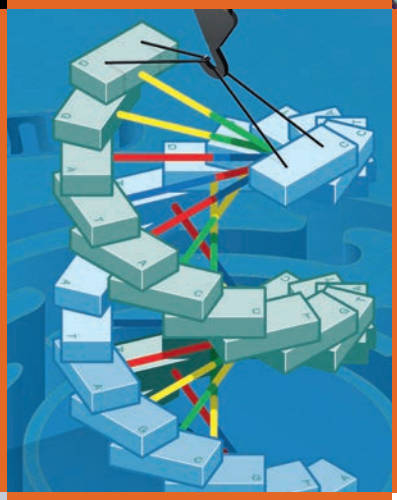
EMBL Grenoble
EMBL Grenoble 40th Anniversary Symposium

June
10-11

EMBL Heidelberg
EMBL Conference: The human microbiome

June
21-23

EMBL Heidelberg
EMBO | EMBL Symposium: Enabling technologies for eukaryotic synthetic biology



July
4

EMBL Heidelberg
Summer party

July
10

EMBL Heidelberg
Lab Day/John Kendrew and Lennart Philipson Award Ceremonies/EMBL Alumni Association board meeting

September
5-8

ICC, Birmingham
The EMBO Meeting 2015 (EMBL staff-alumni reception on September 7)

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EMBL.ORG/EVENTS