

Off the BENCH

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The Eppendorf – LifeScienceStyle Magazine

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NATURE

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presented by
eppendorf

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MASTHEAD

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Editorial

Dear Reader,

Digital transformation plays an increasingly important role in everyday research – device and data networking in the laboratory now rank among the major topics of discussion. Those who visited last year's Labvolution will have experienced these innovations first hand: the Eppendorf booth, itself fully networked, introduced for the very first time the new VisioNize® system by Eppendorf. It allows the user to interconnect, monitor and manage multiple Eppendorf instruments with a central software application – in the laboratory as well as on the road – using the mobile iOS app VisioNize go.

In our News section, starting on page 32, you can learn at which leading global trade fairs you can find our latest innovations. Our products help scientists worldwide advance their research. The new Commercial Organization Division within the Eppendorf Group under the leadership of our new board member, Eva van Pelt, provides new impetus. On page 31, we will introduce our new director who started at Eppendorf on 1st October 2017 and her area of responsibility.

We will also portray the highly decorated evolutionary geneticist Pardis Sabeti. She has dedicated her professional life to the goal of ridding the world of deadly epidemics caused by viruses such as Lassa and Ebola. The fact that the researcher still finds the time to perform with her rock band on the stages of Boston makes her all the more remarkable. Meet Pardis Sabeti – starting on page 6.



More often than not, the best inspirations stem straight from nature itself. This is why two articles have been dedicated to this topic. Animals and plants provide researchers with valuable ideas for innovative product developments. Spending time surrounded by nature is not only good for your health; incidentally, it also promotes creativity.

So – a leisurely walk in the Frankfurt city forest may just be the ideal setting in which to process all those impressions gained on the sightseeing tour. Our city portrait shows that the metropolis on the Main River – which will host the leading international exhibition of the processing industry, ACHEMA® – has much more to offer than finance.

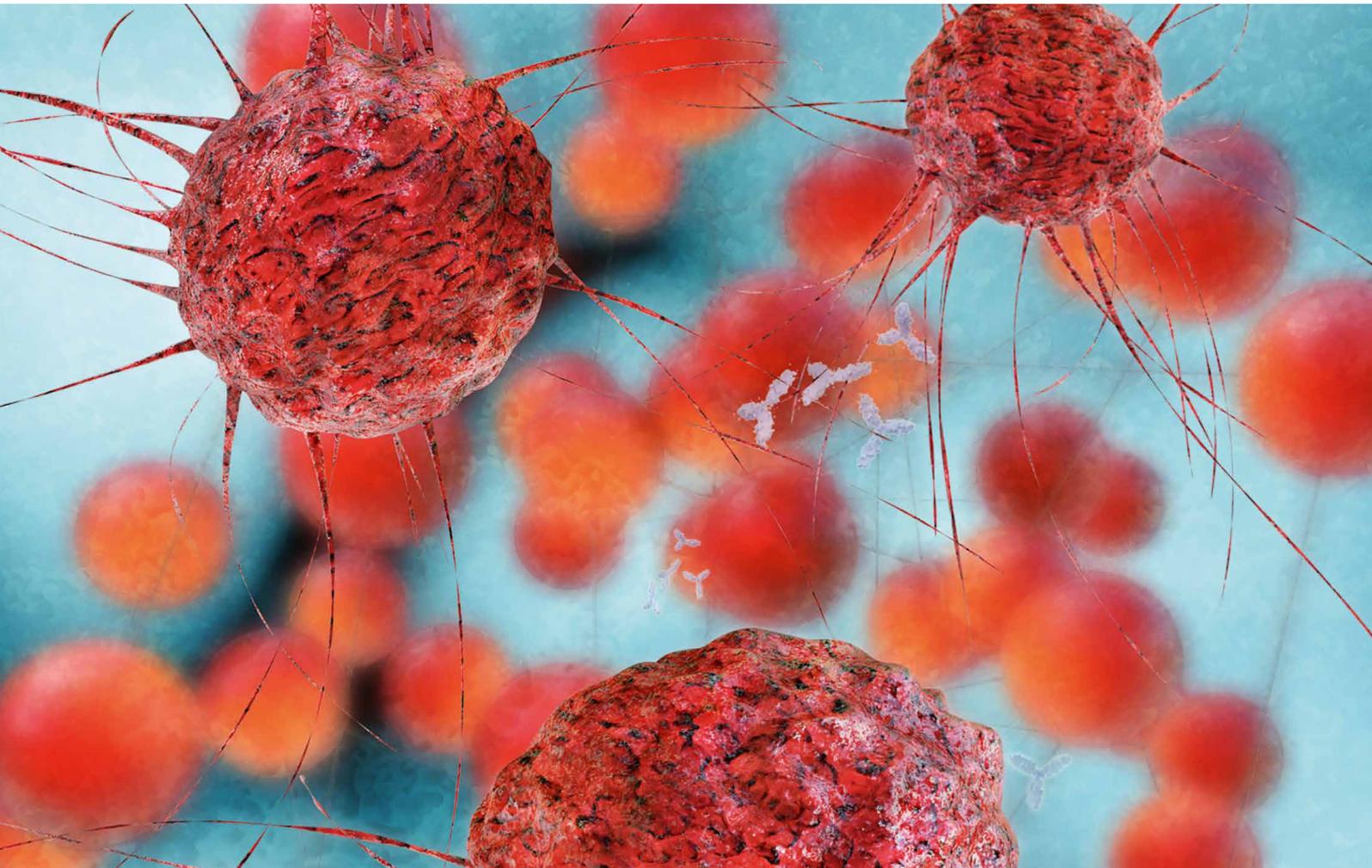
We hope you will enjoy the read,

Thomas Bachmann
Chairman of the Management Board

PS You would like to experience "Off the Bench" in digital format? Then visit our website!

www.eppendorf.com/otb

Discovered & Developed



Targeting Cancer

Tumors that are invisible to the immune system present a crucial problem to cancer therapy. A novel approach to a solution has been developed by two research teams, headed by Steven Rosenberg at the NIH and Carl June at the University of Pennsylvania. They tested the application of the artificial CAR molecule by harnessing a method that is well-established in the field of gene therapy: they isolated T-cells, a special type of immune cell, from the body of a patient, and transplanted them with the gene for the CAR molecule. The resulting CAR T-cells

were then propagated in the laboratory and subsequently infused back into the patient. The CAR molecule serves to support the immune system in detecting and eliminating camouflaged cancer cells. At this time, however, considerable side-effects and the high cost of manufacturing still preclude widespread application.

Experts hope that the cells will be amenable to automated production in the future – a promising approach, the development of which is being actively pursued, and which could lead to substantial cost reduction.

The German research team led by the Mainz scientist Ugur Sahin is already one major step ahead. With their new, universal and highly effective type of cancer vaccine, microscopic fat droplets that have been loaded with cancer search motifs for tumor cells are injected into patients.

This mock virus infection then causes the body to activate all available immune cells. The vaccine has already shown success in three patients with advanced skin cancer. This form of therapy could reach market maturity as early as five years from now.

Cancer research
New therapies offer
approaches to
solutions in the battle
against cancer



Unmeltable ice cream

Sticky fingers – a thing of the past! Quite by chance, two Japanese researchers discovered how ice cream may be enticed to keep its shape longer. The secret: polyphenols from strawberries. This plant substance ensures that the fat contained in ice cream will cover the frozen water and bubbles like a protective coating. The resulting ice cream is able to resist melting, even after being exposed to 30 degrees in the shade for half an hour.

Rediscovered giants

The tree-lobster is considered one of the rarest insects in the world. After a rat invasion killed off most of the tree-lobster population on Australia's Lord Howe Island, the 15 centimeter long herbivore was deemed extinct. A genetic test recently confirmed that some of the insects had indeed survived. Researchers are planning to reintroduce the species; zoo-reared tree-lobsters are to be settled on Lord Howe Island by mid-2018. But first, the rats will have to go.



Smart gum

In the future, a type of chewing gum is expected to detect bacterial mouth infections at an early stage. A special ingredient reacts with the protein-degrading enzymes present during inflammation. These enzymes will digest the special ingredient, and within a few minutes, the gum will release a bitter tasting substance. This approach is deemed especially useful to recipients of tooth implants, which, due to the inherent lack of enervation, are slow to perceive infections within the mouth.



0.00 Percent Blood Alcohol

The British scientist David Nutt has developed a synthetic “ersatz”-alcohol. The substitute allegedly simulates the pleasant effect of alcohol – entirely without the hangover or the dangers of addiction.

A new approach to AIDS therapy

While the inhibition of HIV replication inside the body has been successfully mastered in recent years, this process is not capable of eliminating latent HIV reservoirs. As soon as the administration of medication is interrupted, the body's viral load is bound to increase once again. Researchers at Kumamoto University in Japan have now devised a novel approach which is geared towards eradicating the virus reservoir in its entirety. During the course of “Lock-in and apoptosis”, the compound L-HIPPO, which binds to the HIV protein Pr55Gag, is synthesized. This will render the virus unable to leave the host cell. As soon as L-HIPPO is added to the infected cells, the virus is sequestered inside the cell – and the cell dies.



Always a step ahead
With passion and conviction, Pardis Sabeti studies the genetic evolution of the most aggressive viruses worldwide



Race Against the Virus

RESEARCH CAREERS

Pardis Sabeti, passionate fighter for global health, considers infectious diseases such as malaria, cholera or Lassa fever the greatest scourge of mankind. The sequencing of the Ebola virus in West Africa earned her the Time Magazine title of “Person of the Year” as one of the Ebola Figthers, and named one of Time’s “100 Most Influential People”.

The object of study
The Ebola virus –
simulated on the
computer



If given the chance, Pardis Sabeti would have liked to have traveled around the world with Charles Darwin and Alfred Russell Wallace, “as they explored the planet’s amazing diversity and conceptualized their theories of natural selection.” Galileo, too, would have piqued her interest as he studied the planetary system, as well as Charles Lyell “by uncovering the principles of geology”.

Pardis Sabeti loves every aspect of science and the people whose spectacular inventions revolutionized the world: those who measured and calculated, those who looked through microscopes and telescopes and those who discovered the tiniest of organisms and the vast expanses of the universe. However, her admiration is not limited to the great and important explorers; she embraces all those nameless women and men who influenced the course of life on earth without earning a mention in the history books. “I would have loved to have worked with many of them as they made their amazing discoveries.”

Today, the 41 year old evolutionary geneticist leads her own laboratory, which is a part of the Center for Systems Biology at Harvard University and works at the Broad Institute of MIT and Harvard, and it is where she herself makes groundbreaking discoveries.

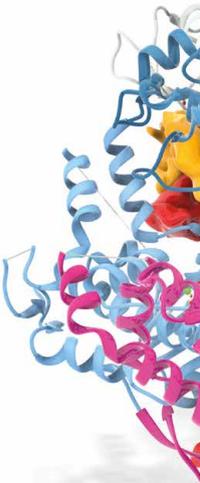
Saving humankind from deadly viruses

As a leading scientist in the field of computational genetics, Dr. Sabeti searches for the root causes of epidemics, such as, for example, Lassa fever, Zika and Ebola. Her mission: to protect humankind from deadly infectious diseases. In her laboratory, the biologist is developing techniques that will help scientists recognize and characterize viruses earlier as well as better trace their paths of transmission. “Infectious diseases are one of the strongest pressures on human populations”, says Dr. Sabeti. She and her team find themselves in a perpetual race against the viruses as these mutate over time and thus constantly present them with new challenges: “And at any point, mutations can occur that can turn a deadly disease into a global epidemic”, warns the scientist. “We cannot necessarily predict which spark will ignite, but we can create global surveillance systems to put out the fires as they start.”



“Let us not let the world be defined by the destruction wrought by one virus, but illuminated by billions of hearts and minds working in unity.”

Computer simulation of CRISPR-Cas9
„CRISPR will revolutionize the field of medicine”, says Pardis Sabeti



Meeting of scientists at the Broad Institute
Dedicated to research for a life without deadly epidemics



CRISPR revolutionizes medicine

One tool that Pardis Sabeti employs in order to develop better, field-deployable, potentially paper-based diagnostics for viruses, is CRISPR. These so-called gene scissors, celebrated by scientists across the globe, will, according to Pardis, revolutionize the field of medicine. CRISPR is capable of editing DNA and RNA and thus manipulate the genome with unprecedented accuracy. “We and others are also developing sequencing technologies to identify what causes human sickness in any patient sample without knowledge of any symptoms, broadly testing all potential microbes”, says the researcher. Pardis Sabeti summarizes her scientific mission: “In essence, we conduct genomic epidemiological studies, using fine tools of genomics to understand and respond to outbreaks.”

Pardis Sabeti was born in Tehran, Iran, in 1975. Her father Parviz was a high-ranking officer of the Shah regime. At the height of the Iranian revolution, when Pardis was just two years old, the family fled to the United States and later settled in Orlando. “In the early days my entire family lived together in a very crowded house, where I shared a room with my sister, cousin, and grandmother, and we would all listen to my grandmother tell stories before bedtime”, Pardis remembers. Even as a child, she was hungry for

stories and keen on knowledge. Her mother Nancy came up with a plan. She purchased old school books, a blackboard and a few school chairs and thus set up a summer school for her daughter at her home. Pardis’s sister Parisa, two years older and already in school, was appointed her teacher. Parisa embraced her assignment; she devised schedules and issued report cards.

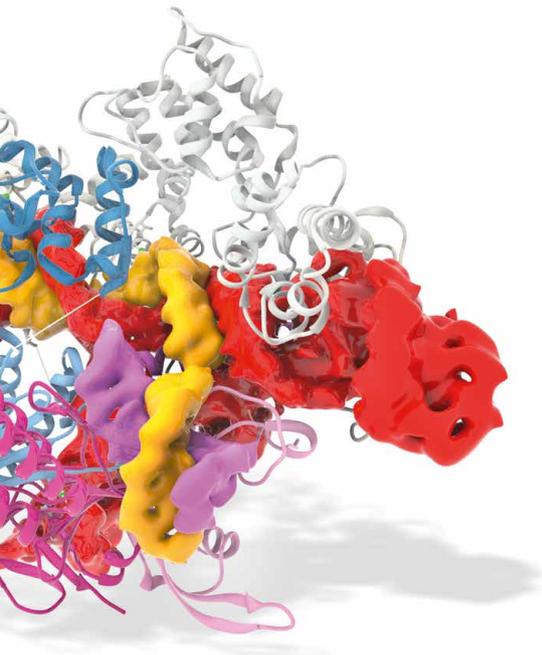
When finally in school herself, Pardis was light years ahead of her peers and discarded her initial plan of owning her own flower shop or becoming a writer. Pardis’s heart longed for science.

Graduating with high honors

She studied Biology at the Massachusetts Institute of Technology (MIT) and graduated with high honors: “Perfect 5.0 Average”. Equipped with the world’s most prestigious scholarship, the Rhodes scholarship, she then earned her doctorate at the University of Oxford in the UK in the field of evolutionary genetics. Dr. Sabeti was fascinated by research. “The more I got engaged in research, the more excited I became about it”, says Pardis. Back in the US, she went on to earn a medical degree from Harvard Medical School in Boston. Not at all surprisingly, she graduated “summa cum laude”; she was only the third woman since the inception of the elite University to achieve this distinction.

“She was able to create this just through sheer force of will”, says Eric Lander. As Director of the Broad Institute and mentor, he has accompanied Pardis Sabeti since the late 1990s. “Pardis has this caring about making the world a better place, really fixing the world.”

The full extent of her convictions became evident in 2014, during the Ebola outbreak in West Africa. Pardis spared no risk and traveled with her team to the heart of the crisis in Sierra Leone. On site, inside the Kenema Government Hospital, the team sequenced virus samples from infected patients. “This marked the first in-depth use of real-time DNA sequencing in the midst of such a deadly pandemic.” The researchers were able to discover that the



virus was indeed transmitted from person to person and not repeatedly coming in from bats and other animals.

Deployment into the midst of the Ebola crisis

Sabeti immediately published her results online to ensure that scientists around the world would be able to join in her fight against Ebola. Her motto: “Let us not let the world be defined by the destruction wrought by one virus, but illuminated by billions of hearts and minds working in unity.” This constituted a rather unusual step which earned her and her team a high degree of attention. She says that “In hindsight, we didn’t care about getting recognition. We just wanted to get the data out to the world.”

During their service in the midst of the Ebola epidemic, many doctors, nurses and scientists gave their lives. Five of her colleagues were infected with the virus and subsequently succumbed to the disease. Nevertheless, the scientist remains con-

vinced “that there is no excuse not to do this kind of work with every outbreak that ever occurs in the future.” As an “Ebola fighter”, Time Magazine voted Pardis one of the most influential people of 2015. In the meantime, the physician is highly decorated with awards, and she is the woman of the hour any time an epidemic rears its ugly head anywhere in the world. Despite all her honors, Pardis Sabeti still remains a warm-hearted person whose primary focus continues to be centered on the well-being of her fellow humans and whose highest inspirations are, in her own words, human potential and human kindness.

She has created a research laboratory that simultaneously serves as a place of connection, where everyone feels at home and where everyone is respected and valued. “We are family. I admire and care deeply for every member of my group”, she says, and she adds: “I want my team to be ambitious and competitive, but not with each other, and not even within their field. Instead, we work towards achieving something in a greater cause: the battle against deadly pathogens.”

Science and Rock’n’Roll

Those who believe that they know everything there is to know about this remarkable scientist are quite mistaken: (drumroll) – Pardis is the rock star among scientists. She is the lead singer in her own band “Thousand Days”; she loves writing music, she plays the bass and rocks the stages of Boston. The band has recorded five albums thus far. Rock music and science – do they fit together? “Of course! Music and science are creative enterprises in my mind, and in that way linked”, laughs Pardis, and she regrets: “There are still not enough hours in the day to do everything I want to do, but I make it work.” What else makes her happy? “Being with friends, family. And: Seeing other people achieve, fighting for my students, breaking through barriers.” Typical Pardis! ■



Music in her blood
The evolutionary geneticist is also the lead singer in her own band “Thousand Days”



Lab research trip in 2013
Pardis Sabeti at the Kenema Hospital, Sierra Leone



THERE’S MORE:
Visit the website of Pardis Sabeti’s lab.

www.sabetilab.org



From Inspiration to Final Product

A fruit serves as a model for a safety helmet and heart implants are made from the silk protein produced by a spider: in the research field of bionics, scientists decode nature's secrets for the development of technological solutions.

At first glance, the pomelo is just a regular fruit. Its taste is sweet and sour, and it resembles a large grapefruit. This may have been the extent of it – if it were not for its extraordinary peel. The pomelo, after all, is equipped with highly effective impact protection. Even if it falls to the ground from great heights, it will not burst open. The reason: the peel condenses at the point of impact and hardens as a result.

The consortium of scientists BISS (Bio-Inspired Safety Systems), led by the

BMW Group, is looking to the pomelo as a model for the development of new protective equipment for factory workers. To this end, the scientists are analyzing the tissue composition and cellular structure as well as the operating principles of the fruit-based shock absorber, and they are in the process of testing its suitability for use in industrially manufactured products. The results are impressive: prototypes such as helmets are up to 20 percent lighter, more robust and more stable than all other materials commonly used at this time.

Innovations of tomorrow

Bionics is the name of a field of research which harnesses materials occurring in nature for the benefit of technological developments. "Bionics arrives at solutions in those areas where they may not be expected", says Professor Harald Luksch, Head of the Leonardo da Vinci Center for Bionics at the Technical University of Munich (TUM) in Germany. According to Luksch, bionics has the potential to "generate the revolutionary innovations of tomorrow."

These include innovations such as the highly efficient solar cell which researchers at the Institute of Technology in Karlsruhe, Germany (KIT) have developed after the model of a black butterfly. The wings of the "common rose" (*Pachliopta aristolochiae*) feature tiny holes that are much more effective at absorbing a broad spectrum of light than any smooth surface would be. The researchers then transferred this nanostructure to the silicon layer of a thin film solar cell – and were able to increase the



Pomelo, black
butterfly, a spider web
Sources of ideas that
fuel innovation

“

The human creative genius can invent different things (...), but it will never succeed in creating one that is more beautiful, economical or straight than nature, as its inventions lack nothing, and nothing is superfluous.”

Leonardo da Vinci, artist,
universal scholar and founding
father of bionics

rate of light absorbance by up to 200 percent.” This does not automatically translate into an increase in efficiency of the entire solar power unit to the same extent”, cautions Guillaume Gomard of KIT. At the same time, however, solar modules featuring such nano-structures were capable of considerable enhancement, even on an industrial scale.

Swift as ants

The insect that has inspired Japanese scientist Katsuhiko Nishinari, who conducts his research on traffic jams at the University of Tokyo, is even smaller than the butterfly: the ant. He discovered that on ant trails, traffic flows steadily, even under conditions of extreme congestion. Their secret: the continuous sequence of stop and go leads to an effective flow of traffic. Ants also distribute information by leaving a scent on the ground, allowing them to react to a new situation in a flexible manner. In accordance with this model of communication, Nishinari developed a system for customs at Narita airport in Tokyo. As soon as a plane departs for Japan, the airline reports the number of non-Japanese passengers. The airport is then able to prepare for the number of incoming tourists in a more efficient manner. As a result, waiting times at customs have been cut by half.

The field of materials science, too, is inspired by living organisms that may otherwise be considered plain. Scientists at the University of California at Santa Barbara have observed that the California

mussel (*Mytilus californianus*) is able to cling to its rocks despite strong wave action and roaring surf. This unshakable strength has been attributed to the ionic bonds within flexible biomolecules.

Following the example of the mussel, the researchers supplemented a polymer with iron nitrate and the organic substance catechol. The result: tensile strength increased 58-fold, while flexibility of the polymer was not compromised in the least. “This work opens exciting lanes of discovery for many commercial and industrial applications”, says Megan Valentine, Professor in the Department of Mechanical Engineering. The approach of rendering flexible synthetic materials more robust may be useful, for example, in the development of shock-proof smart phone cases.

The investigative spirit meets patience

Whether it is exterior paint which, by modeling the head-stander beetle, dries in an instant, or heart transplants based on the silk protein produced by a spider: bionic approaches are ubiquitous across all possible areas, including energy, architecture, medicine, mobility and materials science. That being said, it takes years until a research project matures into a final product, and patience is of the essence. “The eureka effect at the moment of discovery is always grand”, says Professor Luksch of the Technical University of Munich. “But it requires endless basic research to take the inspiration all the way to a practical product.” ■

INFOBOX

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Large economic potential

Bionics is firmly established as a method for innovation. Thanks to the limitless creative potential of nature, it continues to generate new developments and product optimizations. However, not all bionic patents will mature into a marketable product, as ideas often fail to bridge the gap between the university and the marketplace. Nevertheless, the California-based Fermanian Business & Economic Institute at Point Loma Nazarene University in San Diego attributes large economic potential to the field of bionics. By the year 2030, it could potentially contribute \$425 billion to the gross domestic product (GDP) of the US alone.

Source: <https://www.terrapiinbrightgreen.com/tapping-into-nature/> (chapter 1.6)

Pawpaw
Tropical fruit
cocktail in a
single food



Amaranth
Contains many
easily digestible
nutrients and other
vital substances



Saviors of Diversity

Ancient varieties of fruits and vegetables add a welcome change to the kitchen; they thrive in our own back yards, and they are perfectly suited to organic agriculture. This is how initiatives across the globe stand up for the preservation of almost forgotten crops.

Jude and Michel Fanton are enthusiastic amateur gardeners. On their property in Byron Bay on Australia's Pacific coast, more than 1,000 arable plants thrive, among them many exotic ancient varieties of fruits and vegetables such as the sweet and crunchy Yacon root, originating from the Andes, which Michel Fanton, a native of France, prefers to eat fresh from the ground. African cabbage is another example: the leaves and sprouts of this vegetable from Africa will add spice to any salad.

The Fantons advocate for the conservation of as many ancient arable crops as possible. In 1986, the couple founded the "Seed Savers Foundation", which has since grown to include more than 100 local initiatives in Oceania and Japan. The members save and distribute the seeds of edible plants. Since 1992, the Fantons have undertaken regular journeys to promote the diversity of varieties in places such as Asia and Europe, as well as to

exchange experiences and seeds with local farmers and allotment gardeners.

Global movement

The "Seed Savers" are a part of a global movement that has been steadily gaining support – for good reason. "Due to the industrialization of agriculture, the worldwide variety of arable crops has shrunk by 75 percent", says Johanna Gillinger, Chair of the Austrian organization "Arche Noah". Founded roughly 25 years ago, the association has more than 17,000 members and supporters today. Its centerpiece is the "seed archive", one of the largest private plant seed banks in Europe, where experts store and propagate the seeds of more than 6,000 endangered varieties of vegetables, fruits and grain.

The "Arche Noah" web shop features rare gems such as the almost forgotten Indian banana (pawpaw) – the largest edible fruit native to North America. Green on the outside, of medium size and shaped

Sunflower root
Rich in potassium,
calcium
and magnesium



like a peanut, its yellow pulp tastes like an exotic mix of mango and banana. For the longest time, the fruit grew wild; these days, pioneers in the US and Europe are attempting to cultivate the fruit on plantations. Dyed-in-the-wool fans in Ohio even hold an annual pawpaw festival.

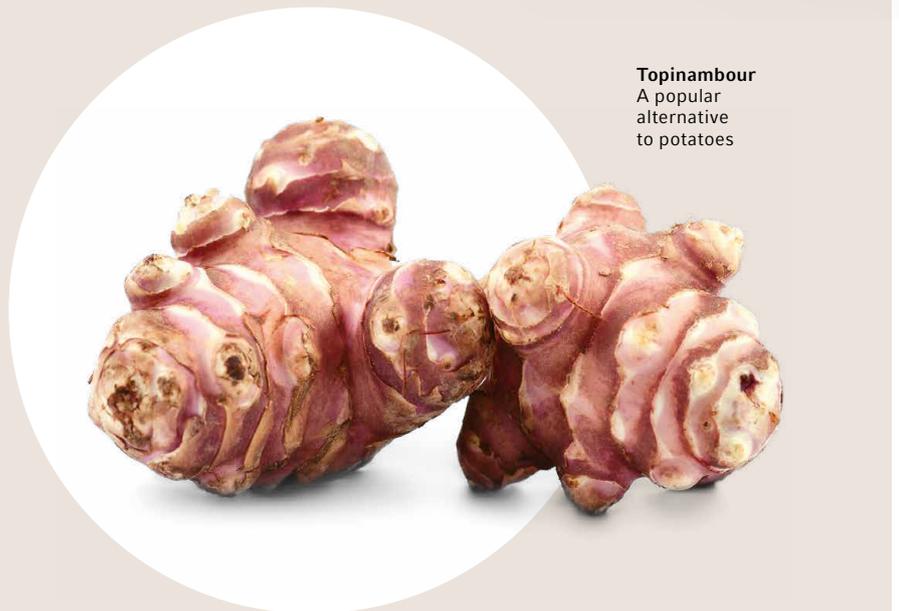
Preserve, share, protect

Initiatives such as “Seed Savers” and “Arche Noah” not only advocate for the preservation of diverse varieties, they also support their free distribution. Whereas in the past, patents exclusively covered genetically modified plants, nowadays even common varieties may be excluded from exchange or sale. This trend is meeting with resistance, led by the US-based “Open Source Seed Initiative”, which trades license-free seed at fair conditions. In addition to root vegetables of various colors, their selection includes the millet-like protein marvel Amaranth, which had been prized by the Aztec, Inca and Maya – and which has more recently become an integral item on the shelves of organic supermarkets.

From the perspective of Roman Lenz, Professor of Agricultural Planning, it is



Puntarelle
Crunchy, fresh and especially delicious if enjoyed raw



Topinambour
A popular alternative to potatoes



quite normal that dietary habits will change over time. He is warning, however, that it is generally not a good idea to rely too strongly on the limited varieties of edible plant species that comprise the arable crops available today. While these do deliver the highest yields under conditions of intense use of fertilizers and pesticides, “factors such as climate change or even novel trends in nutrition can lead to entirely different varieties being suitable, and thus in demand, a few years from now”, explains Lenz. As a co-founder of the network of saviors of varieties “Genbän-

kle”, which roughly translates to “little gene bank”, in Baden-Württemberg in Germany, Lenz advocates for local crops not only to be archived, but also actively cultivated. “A number of the old varieties are so well adapted to regional conditions that they are ideally suited to the local organic agriculture”, he says. In order to sustain worldwide diversity in the long term, the scientist demands: “We must better protect ancient varieties and therefore include legal protection – in much the same way as we protect cultural landmarks.” ■

Vegetables in the Spotlight

Food trend with traditional ingredients: root vegetables, topinambour and others conquer haute cuisine.



With his new German cuisine “Pure Nature”, the decorated gourmet chef **Nils Henkel** delights the patrons of his restaurant Schwarzenstein in the Rheingau region in Germany. Many of his dishes feature ancient varieties of fruits and vegetables. In this interview, he reveals which ones are his favorites, and why we should eat a lot less meat.

You love vegetables, whereas fish and meat play supporting roles in your dishes. Your meal “Flora” forgoes them entirely. What has inspired you to cook in this fashion?

Henkel: in my opinion, we consume way too much meat these days, and moreover, we take it for granted. All the while, humans seem to forget where the meat comes from and under which inhumane conditions these animals are reared. I want to show my guests how exciting vegetable dishes can be.

To accomplish this, you mainly rely on ancient varieties of fruits and vegetables. Where do you source these?

Henkel: Produce from regional or German sources is always my first choice,



Burdock
Known as a scavenger of free radicals

but the diversity available in other countries is also tempting, and certain varieties such as puntarelle or trevisano are typically not available locally. Despite my focus on local foods, I offer a wide-ranging cuisine. I enjoy working with flavors, spices and, generally, influences from across the globe, which I then combine with basic German products.

Do you have favorites among the ancient varieties?

Henkel: I especially enjoy working with sun root, or topinambour, because I like the characteristic flavor. I also value the different varieties of beets because I find the combination of earthiness and sweet-

ness exhilarating. Other exceptional foods include purple salsify and burdock, which are largely unknown to our guests.

Which role do the seasons play in your culinary art?

Henkel: I plan my menu with the seasons in mind, and I select produce when it is in season and tastes best. I respect seasonal closure periods for fish and venison to allow populations to recover. I do not agree with the fact that almost every product from any given location on earth is always at our fingertips, and I would be delighted to see an increase in consciousness for the seasonal nature of our food. ■

Trevisano
Related to
chicory and
endive



*I respect seasonal
closure periods
for fish and venison
to allow populations
to recover ...
I would be delighted
to see an increase
in consciousness for
the seasonal nature
of our food.”*

Huge Cinnamon Roll

Bring your own Recipe



INGREDIENTS

475 g + 25 g flour,
1 packet of dry yeast,
50 g + 75 g + 10 g sugar,
1 packet of vanilla sugar,
1 egg,
100 g + 75 g butter,
200 ml of milk (for brushing),
3 tsp. + 1 tsp. cinnamon,
baking paper

1 Mix well 475g flour, yeast, 50g sugar and vanilla sugar. Melt 100g of butter in a pot over a low heat. Add 200ml of milk and warm to the touch. Add the butter and milk mixture and egg to the flour mixture and use the dough hooks of the electric hand mixer to make a dough. Cover with a damp cloth in a warm place for 60 minutes.

2 Lay out springform with baking paper or grease. Add the remaining 25g of flour into the dough and roll out the dough on baking paper approx. 0.5 cm thick to a rectangle. Stir 75g of butter, 3 teaspoons of cinnamon and 75g of sugar until creamy and spread over the dough.

3 Cut the dough lengthwise into strips approx. 4 cm wide. Roll up the first strip into a roll. Then place the roll on the beginning of the second strip and also roll it up into a roll. So roll strip by strip into an ever larger roll. Place roll in the springform. Cover the cinnamon roll for another 20 minutes.

4 Preheat the oven to 180°C (circulating air: 160°C). Mix 2 teaspoons sugar with 1 pinch of cinnamon. Sprinkle the giant cinnamon bun with milk, sprinkle with cinnamon sugar and bake in a preheated oven for about 25 minutes until golden brown on the other side. No flipping required while baking).

**This is a recipe tip tried
from our editorial team!**

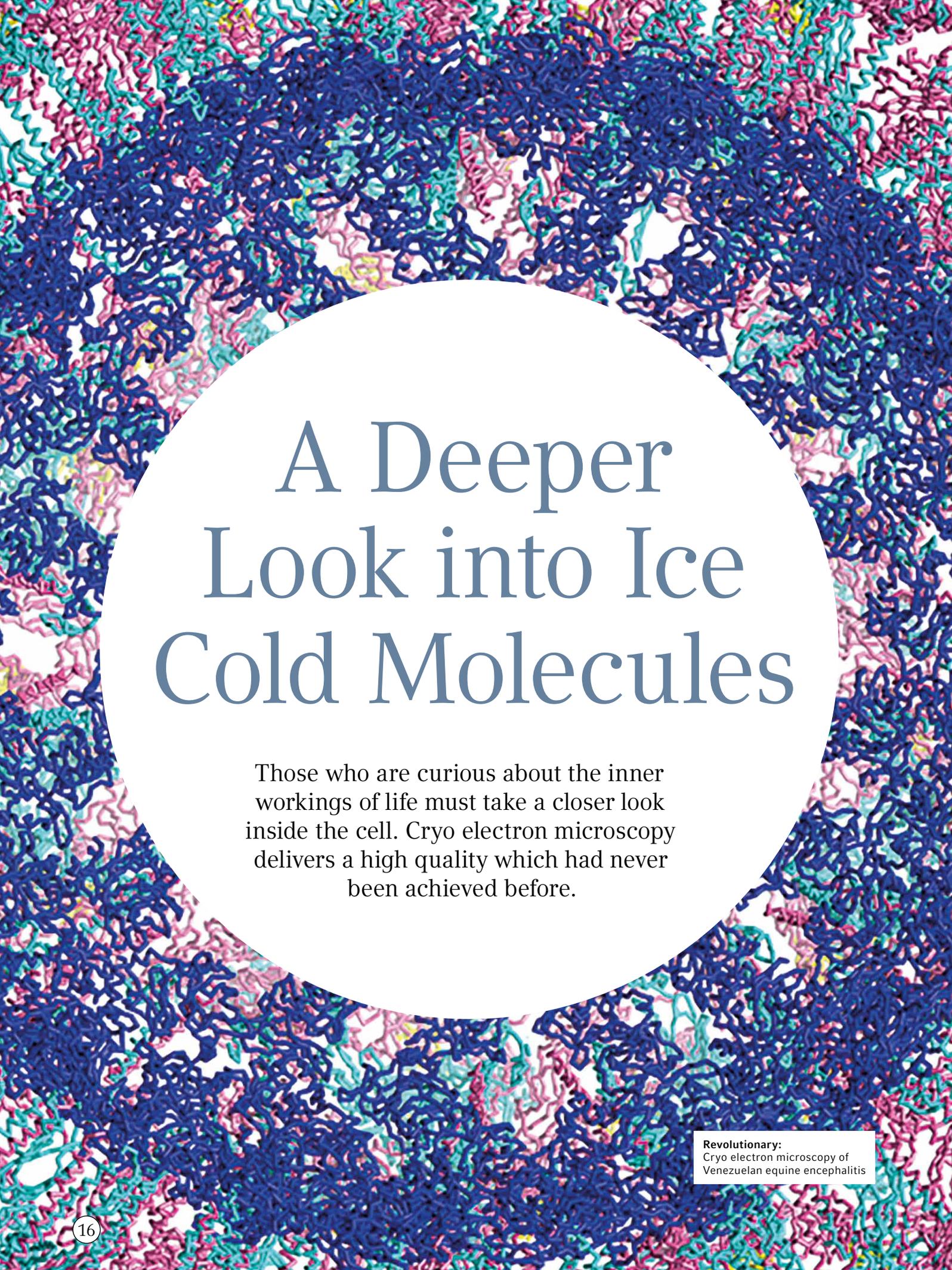
We love it!

Try it and let us know
if you liked it!

What's your favorite recipe?

We want to hear from our readers!
Send us your favorite recipe, along
with a photograph.

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A Deeper Look into Ice Cold Molecules

Those who are curious about the inner workings of life must take a closer look inside the cell. Cryo electron microscopy delivers a high quality which had never been achieved before.

Revolutionary:
Cryo electron microscopy of
Venezuelan equine encephalitis

They were dehydrated, fixed in the standard fashion, embedded in synthetic resins, sectioned and contrasted with heavy metals – samples were subjected to all of these procedures to make them reveal their shapes and structures and allow electrons to pass through them. Until only a few years ago, the observation of biomolecules using classic electron microscopy was associated with enormous effort and its options were limited – a lengthy procedure that destroyed many molecular structures in the process. “Analysis somewhat resembled archeology”, says structural biologist Kay Grünewald at the University of Hamburg.

“We are now able to count individual electrons”

Cryo electron microscopy, or cryo-EM for short, has revolutionized research. Since 2013, new “direct detectors” have permitted a detailed view inside the molecules. Using this enhanced technology, samples may now be studied under life-like aqueous conditions in their native environment. Professor Grünewald explains: “These new detectors even allow us to count individual electrons. That is a major step! We are now able to study biological structures in a life-like state at the atomic level.”

Grünewald, originally from Jena, and his team conduct their research at the Centre for Structural Systems Biology (CSSB) on the campus in Hamburg-Bahrenfeld. This is where researchers from different institutions collaborate in an interdisciplinary manner so as to gain a better insight into the mechanisms which underlie the processes of infection. In addition

Calculating the 3D structures of the most complex samples

to other methods, they utilize cryo-EM in order to contribute to the better understanding of diseases such as malaria and herpes. Professor Grünewald’s research focuses predominantly on the molecular interactions between viruses and their host cells. He explains: “We employ cryo-electron tomography. To this end, we generate a number of projection images while we tilt the object – very much

like computer tomography in the hospital. From these series of tilted images we are then able to calculate the 3D structures of the most complex samples, for example, infected cells.”

Significant contributions to the development of this technological revolution were made by three men, all of whom are now, at over 70 years of age, veterans of science: the Swiss Jacques Dubochet, the native German Joachim Frank and the Scot Richard Henderson (for more details, please see the info box). With a number

The result is a glass-like amorphous ice – a process called vitrification

of technological advances, cryo-EM first attained a broader range of applications during the 1990s. Nowadays, the technology is enjoying such a high level of sophistication that it has enabled the generation of spectacular images including, for example, images of bacteria attacking cells, as well as the structure of the Zika virus.

Detailed research at the atomic level was previously unimaginable

What is cryo, and how do researchers work with cryo-EM? Cryo (also: Kryo) originates from the Greek and means “ice cold”. In the realm of physics, it refers to temperatures below minus 150 degrees Celsius. Professor Grünewald explains the process: “Three essential conditions must be met. We have to freeze the samples very quickly while avoiding the formation of ice crystals. The result is a glass-like amorphous ice. We refer to this process as vitrification”. The samples thus frozen, and chilled to approximately minus 180°C using liquid nitrogen, are then studied in the electron microscope using very low intensity electron radiation. “This is important in order to prevent damage to the structures of biological objects”, says the 45-year-old. To this end, projection images of the sample are generated using highly sensitive cameras. The three-dimensional structure is then calculated from the many individual projection images.

This process offers an important advantage: further to the considerably sharper images and higher resolution of more

INFOBOX

i

Nobel Prize in Chemistry

In early December, 2017, the Swiss Jacques Dubochet, the native German Joachim Frank and the Scot Richard Henderson jointly accepted the year’s Nobel Prize for Chemistry in Stockholm (see picture below). As early as 1975, Richard Henderson succeeded in displaying a three-dimensional protein using electron microscopic images. Jacques Dubochet developed the cryo-preservation process by preventing dehydration of the molecule through instant deep-freezing. Thus, in 1984, he was the first to show viruses in an aqueous solution. Finally, the native German Joachim Frank, while working in the US, spent many years developing reconstruction algorithms and software, and he combined his achievements with Dubochet’s method.



Winners of last year’s Nobel Prize in Chemistry: Richard Henderson (left), Joachim Frank, Jacques Dubochet

complex molecules that are achieved, functional relationships are now visible at the atomic level. “For example, we can now understand how viruses enter a cell, and which path they take within molecular mimicry”, explains Grünewald.

30 to 40 years ago, as the pioneers carried out their ground-breaking experiments, such research into atomic detail was still unimaginable. These days, the enhanced structural information gained from cryo-EM helps decipher basic biological functions as well as understand these on a mechanistic level. ■

Lab Lifestyle

Amusing mishaps

If while tagging an alligator, hands accidentally become stuck to the predator's back; if the exploration of the howler monkeys' habitat leads to the accidental discovery of a drug camp; if alleged medieval bones turn out to be the remains of a chicken – then something has clearly gone wrong with the research. The French illustrator Jim Jourdane has collected these and many other mishaps and illustrated and published them in a humorous manner in his book "Fieldwork Fail". The stories are not simply funny, but also highlight the very human side of science, feels Jourdane. An uplifting read for daily laboratory routine.

makisapa.com



LOTTERY

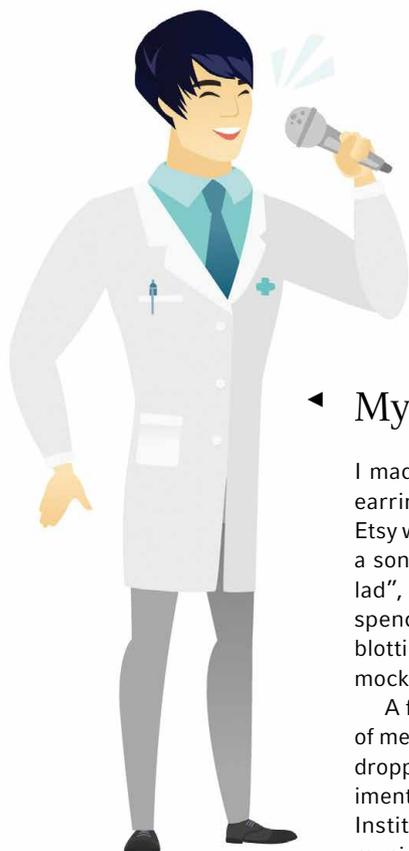


Win a set of Blips mini-lenses!

No microscope on hand? No problem! It is now possible to be just as close to one's object of desire: the Blips mini lenses by the company SmartMicroOptics are simply affixed to the camera lens of any smart phone or tablet, and they can be re-used as many times as needed. They enable high-resolution photography of plants, insects, and even microorganisms.

Eppendorf, in co-operation with SmartMicroOptics, is raffling three Blips lens-sets: **1st prize: Blips Gift Pack** (<http://bit.ly/2jAYust>), **2nd prize: Ultra Lab Kit** (<http://bit.ly/2tXO99Y>), **3rd prize: Macro Kit Metal Series** (<http://bit.ly/2gO9WuY>). Send us an e-mail to magazine@eppendorf.com or register as a subscriber and leave a message with the keyword "Blips lenses". The deadline for submission is June 22, 2018. Please find the terms and conditions on our website www.eppendorf.com/otb.

www.smartmicrooptics.com



◀ My stage is a lab

I made my first Eppendorf tube earrings back in 2006 – before Etsy was a thing at all. I also wrote a song called “The Biotech Ballad”, singing the adventures of spending your Saturday nights blotting in the lab. My colleagues mocked me, a lot.

A few years later the arty side of me started to riot, so I proudly dropped out of my PhD in Experimental Audiology at Karolinska Institutet to become a full-time musician. A street musician in Barcelona, to be precise.

Little did I know that once a nerd, always a nerd: you can leave a lab, but the lab will never leave you. So what do music, studios and cabaret have to do with labs and science? A lot, I tell you. Naming your music project “Stereochemistry” is just the tip of the iceberg.

When you are stuck in a recording studio trying to clean up some audio someone has brought to you, you’re swimming neck deep in the signal-to-background-noise sea again. As if it were a mass-spectrometer. Just that your sample has been col-

lected and processed in unknown conditions you have absolutely no control over. And that clean, tidy peak will sometimes elude you.

Same goes for editing videos shot in low-light conditions: you end up invoking the spirit of Joseph Fourier and bestowing endless blessings on his transform that made the entire digital media manipulation possible. All that math paid off. The infamous Organic Chemistry comes in handy when it comes to building your own costumes. A lab geek will never mix addition and condensation curing silicones, nor will she underestimate the influence of

ambient temperature on the polymerization rates. She will also know how to properly mix and degas viscous fluids with no standard lab tools on hand.

So yeah, I now may be sporting a corset, a tutu and a pair of stilettoes instead of a lab coat, nevertheless, my stage is a lab – and I am a scientist.

MSci in Biotechnology and half a PhD in Experimental Audiology, **Karla Hajman** is a full-time musician and artist that now studies humankind from off the stage with her solo project “Stereochemistry”. She is often found polishing up her German on various Science Slam stages across Germany.
<http://stereochemistrymusic.com>

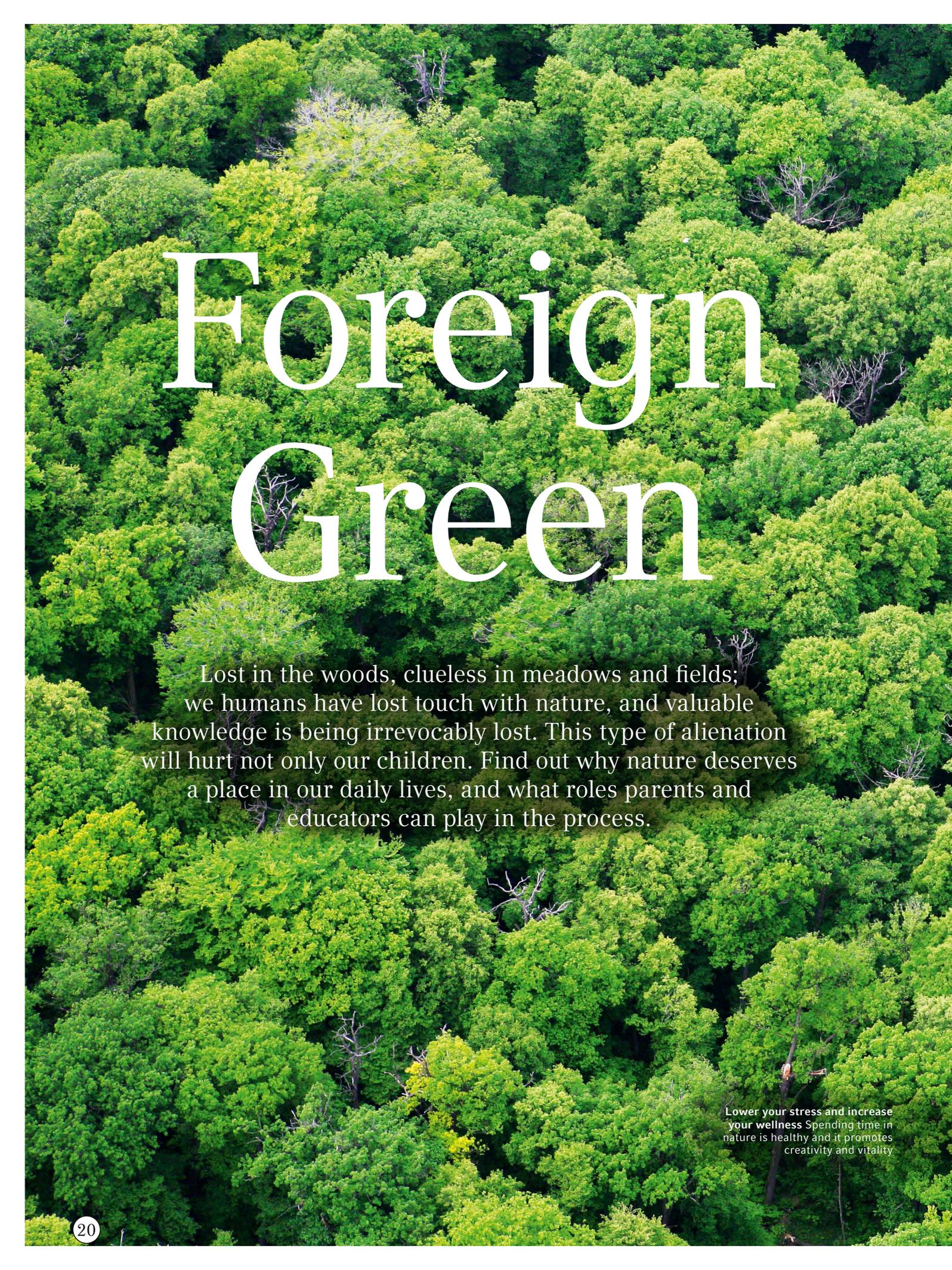
Arts and crafts in the lab

We, the members of the Off the Bench editorial team, have taken advantage of a creative break in order to experiment with our pipettes. The result: these little art pieces – three cute dogs. Aren’t they just almost life-like? What can you build from Eppendorf consumables? Send us your art piece to magazine@eppendorf.com – a selection of creations will be published in the next issue of Off the Bench as well as on our website. We look forward to your submissions!



At the Bench





Foreign Green

Lost in the woods, clueless in meadows and fields; we humans have lost touch with nature, and valuable knowledge is being irrevocably lost. This type of alienation will hurt not only our children. Find out why nature deserves a place in our daily lives, and what roles parents and educators can play in the process.

Lower your stress and increase your wellness. Spending time in nature is healthy and it promotes creativity and vitality.

Peter Wohlleben knows what trees feel. “If an oak tree is afraid, it will grow many small branches along its trunk. If a spruce feels stress, its scent, somewhat spicy-aromatic, may remind us of our last vacation in Spain, whereas in reality the trees are communicating to each other that they are thirsty”, explains the forest ranger and book author. For many years he has conveyed knowledge of the forest, and he takes children on field trips, just like in his latest book *“Hörst du wie die Bäume sprechen?”* (Can you hear the trees speak?) His primary goal is to evoke curiosity. “Perhaps the book will succeed in inspiring the whole family to simply spend more time outside in the forest”, hopes Wohlleben. With his books, field trips and seminars at the Forestry Academy of Rhineland-Palatinate’s Wershofen in Germany, the forester closes knowledge gaps.

Crucial nature education

One look at the results of the 2016 “7th Youth and Nature Report”, which for the past 20 years has provided insight into the relationships that young people have with nature, clearly highlights the importance of the work done by people like Peter Wohlleben. Only 12 percent of those surveyed were able to name three edible fruits that grow in German forests or on the edge of forests. Among the wrong answers were mostly domestic fruits such as apples and pears, but mangoes, bananas and pineapples were also mentioned. The nature sociologist Rainer Brämer had more than 1,000 students between grades 6 and 9 in North-Rhine Westphalia interviewed for the current study.

There are a number of possible reasons for the increasing alienation of young people from nature. According to a study conducted by the United Nations, 75 percent of the population in industrialized nations lives in cities. In addition, the range of in-

door leisure activities has increased. Half of those interviewed for the “Youth and Nature Report” indicated that they spent at least three hours a day in front of a screen. This development has also been noted by Richard Louv, author of the book *“Last child in the Woods”*: “Human beings have been moving more of their activities indoors since the invention of agriculture, the Industrial Revolution, and through continuing urbanization. Social and technological changes in the past three decades have accelerated that change in both cities and rural areas.” Until now, however, no study has been able to establish a causal link between alienation from nature and the use of media. Louv says: “Technology now dominates almost every aspect of our lives. In and of itself, technology is not the enemy; but the lack of balance in our schools and lives, I believe, can be lethal.”

Alienation with consequences

The increasing loss of experiences involving nature is not a new phenomenon. Louv became aware of this development as early as the late 1980s, when, while conducting the research for *“Last Child in the Woods”*, he interviewed nearly 3,000 children and parents in urban, suburban and rural areas across the United States. His observations coined the term “Nature deficit disorder”. Louv: “It is not a medical diagnosis, but a term I devised to describe what I believe are the human costs of alienation from nature.” According to Louv, children not only lose their creativity, but they are also deprived of their vitality. Attention difficulties and higher rates of physical and emotional illnesses could be among the consequences. Louv further states that the lack of experiences in nature will hurt not only our children: “I think of nature deficit disorder as more of a disorder of the society – it shapes adults, families, whole communities and the future of our stewardship of nature.”

Healthy Green

The Dutch study “Green space, urbanity, and health: how strong is the relation?” showed that city dwellers who are surrounded by green space are less prone to stress and that they are healthier in general. In Japan, the realization that time spent in nature has a positive effect on health and well-being has been incorporated in the National Health Program since 1982. “Shinrin Yoku”, forest bathing, is a recognized scientific discipline as well as a therapy. Walks in the woods are deemed to lower blood pressure and pulse as well as levels of the stress hormone cortisol, and they strengthen the immune system. Europe’s first spa and healing forest is currently growing on the island of Usedom. An area of 266 hectares will be home to various paths and therapy stations which are meant to contribute to the relief of cardiac and circulatory problems as well as respiratory and neurological ailments.

Many fields include approaches that counteract nature alienation. Louv: “We’re seeing new appreciation for these issues among parents, educators, pediatricians, mayors and others. And we’re seeing strong countertrends – such as the growth of nature-oriented schools.”

According to the Federal Association of Nature and Forest Daycares, more than 1,500 nature and forest daycares currently operate in Germany. In Berlin, one of the first forest schools in Germany, the Nature School Blankenfelde, opened as early as 2007. The Nature School “Am Brosepark” in Berlin-Pankow opened its doors this year. Its goal: children are to experience their environment consciously. Twice per week, instruction takes place outdoors. Richard Louv views the future optimistically: “We’re hopeful that the culture is beginning to move in a different direction.” ■



Loose Goods

Resolute and plastic-free – the zero waste movement relies on maximum waste prevention as well as on sustainable consumption. These are the steps to take when leading a life – almost – without garbage.

Sustainably packaged
The zero waste movement makes an important contribution to environmental conservation



GLOBAL BULK

Bea Johnson and her family are different. They lead a life that is as close to waste-free as it could possibly be – in the center of California. Whereas the average American generates roughly two kilograms of garbage a day, the amount of waste produced by the Johnsons in an entire year will fit neatly into a canning jar. Since 2008, the blogger and author who originally hails from France has been living in accordance with the principles “Refuse, Reduce, Reuse, Recycle and Rot”. She sold 80 percent of her belongings, and she rejects superfluous waste such as advertising flyers and plastic packaging of food; she advocates for more conscious consumption and for reusable products, for recycling and composting. According to Johnson, sustainable consumption begins long before the trip to the supermarket. In her book “Zero Waste Home”, she writes: “Zero waste takes into consideration both direct and indirect forms of consumption. It is not about recycling more;

it’s about acting on needless waste and stopping it from coming into our homes in the first place.” Johnson is considered the pioneer of the zero waste movement, whose motto is the reduction of garbage. Not generating any waste at all is a purely idealistic goal, even according to Johnson, which, in light of the reality of today’s production methods, is impossible to attain.

Achievable waste prevention

It’s the many small steps that count: an experience that was shared by the German blogger Shia Su – who was inspired by Bea Johnson. “When my husband and I began to avoid generating garbage, we started with the simple things. For fruit and vegetables, we used laundry nets instead of plastic bags. Since there was no bulk food store in our neighborhood, we began to ask our organic food store for wholesale packages of staples such as rice. One by one, our habits changed.” By the end of the year, their garbage filled a mere 750 milliliter canning jar. The most surprising revelation: “Every little bit helps

– a lot!” “Zero Waste is not magic, but rather the sum of many small, very feasible steps”, says Shia Su. In her blog *Wasteland Rebel!* she shares practical and workable information and tips on all things to do with waste prevention and sustainability (see box to the right).

Stopping the plastic flood

Since the early 1950s, humanity has produced approximately 8.3 billion tons of plastic – such are the conclusions reached by the authors of the study “Production, use, and fate of all plastics ever made”. This is an unimaginable amount, equivalent to the mass of one billion elephants.

A large proportion of this plastic waste has become a part of the environment, with landfills still representing the most desirable option. The amount of plastic waste is expected to increase to twelve billion tons by 2050. According to a study by the Cologne Institute for Economic Research, an average of 37 kilograms of plas-

tic garbage per person was generated during 2015 in Germany alone.

“The global problem of ever increasing plastic waste that pollutes the land, the rivers and the oceans is increasing, and with it the necessity to do something about it”, says Tobias Quast, waste expert at the German Association for the Environment and Nature Conservation (BUND). To him, the zero waste movement is not a short-lived trend, but rather an important contribution to avoiding the generation of more waste. Quast: “We are at the beginning of a shift in consciousness.” Marie Delaperrière knows that it is a process that will require time. In 2014, she opened Germany’s first bulk store in Kiel. Since then, packaging-free stores have opened across the country. The topic is slowly reaching the German economy. BUND expert Quast reports: “Right now, a large German chain of organic supermarkets, in collaboration with the Faculty of Business Psychology at the University of Darmstadt, is studying how their customers feel about bulk foods.”

“If everyone were to question their consumer habits, our environment would stand to profit greatly.”

The German zero-waste blogger Shia Su has been visiting bulk stores. Right now she is spending a year in Canada. She shares her extensive shopping reports at

www.wastelandrebel.com/en.

Unverpackt, Kiel, Germany

Products are available in bulk and displayed in dispensers. Customers fill their own containers that they bring from home. Products that are approaching their sell-by dates are donated to the food sharing initiative in Kiel.

www.unverpackt-kiel.de

GOODsONLY, Zutphen, the Netherlands

A small but exquisite selection of mostly bulk products. Goods are delivered via bicycle courier upon request.

www.goodsonly.nl

West Coast Refill, Victoria, Canada

A small zero-waste store that offers environmentally friendly and affordable household products and personal care items.

www.westcoastrefill.com

Still, this way of environmentally friendly shopping is far from being the standard. “Certain trends will develop very quickly in our consumer society, while others take longer to establish, but it is these that are here to stay”, says Marie Delaperrière. In her store, customers may bring their own containers to buy bulk products. From grains and spices, milk and candy, to cleaning products and cosmetics, everything is available in bulk and for self-bottling. In Delaperrière’s opinion, environmentally friendly shopping is not a question of budget. “It is mostly about being clear on what one really needs.” To Delaperrière, zero waste goes beyond merely buying in bulk. “It is grounded in a basic belief. If every human being were to question their consumer habits, our environment would stand to profit greatly.” For her, every step in the direction of zero waste counts. ■



Change in perspective
Alongside other skyscrapers,
Tower 185 shapes the
characteristic view of the
Frankfurt skyline

Finance, Fine Arts, Food

Frankfurt's entertainment value is often underestimated. At the same time, the city on the Main River offers a variety of highlights away from the banking towers. Frankfurt's museum embankment, in particular, is always worth a visit, no matter the season.

Certain cities evoke a sense of longing; for example, Hamburg with its port and its aura of worldliness, or trendy Berlin, a magnet for creative types from all over the world. But Frankfurt? This is where billions are being moved and the economy is buzzing. Even Johann Wolfgang von Goethe considered his birthplace to be mainly a starting point for his extended travels. "In a city like Frankfurt, one finds oneself in a curious situation; forever do passing strangers point towards all areas of the world and awaken the desire to travel", stated the poet laureate in his autobiography "Poetry and Truth".

Livable Metropolis

The city in the center of Germany has more to offer than the bull and bear markets and business. The parks of the campus of Goethe University are brimming with hundreds of students; they debate and laugh, and they cheerfully answer the questions of passing visitors. Yes, Frankfurt is a top-notch city for studying, everything is very international. Well, yes, housing is expensive, but the standard of living is high. This assessment has been verified by a number of studies. During the past few decades, Frankfurt has progressed to become one of the most livable larger cities within Europe, if not the world. According to an analysis by "The Economist", the metropolis on the Main River ranks 6th among the most livable major cities in Europe, and on a global scale, Frankfurt achieved 20th place. According to the "Sustainable Cities Mobility Index", Frankfurt even holds first place for ecology.

Last, but not least, the economy. Here, at the famous Institute for Social Research, is where representatives of the Frankfurt School including Max Horkheimer, Theodor W. Adorno and Herbert Marcuse developed their ►

“critical theory”. However, all visitors, even those who do not wish to tackle critical philosophies, will definitely get their money’s worth.

An ideal starting point for your exploration of the city is the Senckenberg Park in the vicinity of the Senckenberg Research Institute. The paleo-biological educational trail situated among green meadows is lined with exhibits from the Senckenberg Museum that originate from deep within our earth’s history. The picnic next to an enormous dinosaur evokes memories of the Spielberg movie Jurassic Park. Those who are eager to learn more about earth’s history and evolution should definitely participate in one of the exciting tours of the museum.

Art for every palate

Following the excursions into scientific highlights, it’s now time for art, which is on display at a number of museums in Frankfurt. The cultural section of the “Frankfurter Allgemeine Zeitung”, one of the most renowned daily newspapers

in Germany, offers so many suggestions that it is difficult to make a decision. The Schirn Art Museum, for example, is always a good choice. The exhibit “Glamour and Plight in the Weimar Republic” offers profound insight into the art at the time between the two world wars; the images and political placards speak to the psychological premonition of the looming catastrophe.

After so much serious history, a break is a welcome opportunity to experience Frankfurt’s ease and zest for life. The Main River attracts people from all corners of the world and from all professions, and local Hessians welcome everyone with open arms. Conviviality is paramount, and it is easy to make new friends during carefree hours in bars and “Äppelwoi” restaurants (please see below, point 3). In case it happens to be too early in the day for Hessian cider or beer, a number of cafes along the embankment of the Main River, including the one inside the German Museum for Architecture,

offer cake and cappuccino. The view of the Main is breathtaking, life is good, and all our senses are now ready for more exploration.

Literally only a minute’s walk from the Museum of Architecture, the German Film Museum is located inside a historic villa – paradise for movie buffs. Friends of comic art should amble across the iron foot bridge “Eiserner Steg” towards the museum “Caricatura”. It is home to more than 4,000 original caricatures of the “New Frankfurt School” with works by famous artists, including F.K. Waechter, Chlodwig Poth and F.W. Bernstein, the co-founders of the satire magazines “Pardon” and “Titanic”. Enjoying an Äppelwoi, which loosely translates to “apple wine”, one may reminisce about the actions and provocations of these satirists whose books and magazines line the bookshelves of millions in Germany. This agenda item alone will make the trip to the metropolis on the Main River worthwhile. ■

LET’S GO!

Relax, discover, enjoy: where else to go in Frankfurt.

SCIENCE IN FRANKFURT

ACHEMA®, the largest exhibition in the processing industry for chemical technology, process technology and biotechnology worldwide, takes place in Frankfurt, Germany, every three years. Once again this year, from June 11–15, Eppendorf will extend you a warm welcome. You can find the Eppendorf booth in hall 4.1. at booth number B35. There we will feature our latest products such as the BioFlo® 120 bench-scale bioprocess system for cell culture and fermentation. In addition, we will present an integrated software solution for bioprocess control, experimental design and statistical analysis. We will also feature our new biological shaker – the Innova® S44i, the new PCR thermal cycler – the Mastercycler® X50 and the Centrifuge 5910 R which combines high capacity with exceptional flexibility.



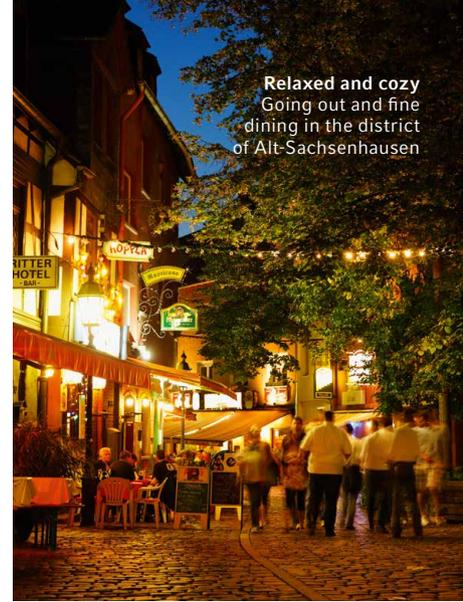
Those who have had too much urban excitement can now join a number of tours into Frankfurt’s extensive green belt or take a break in **FRANKFURT’S “STADTWALD” (“CITY FOREST”)**, Germany’s largest urban forest which covers an area of close to 6,000 hectares. This paradise of nature is home to many species of trees such as oak, beech, Scots pine, birch and spruce, as well as large numbers of forest-dwelling animals including wild boar, deer and hare. Those looking to relax have a total of 450 kilometers of trails at their fingertips on which to hike, run, cycle or simply watch riders on horseback pass by. Other pastimes available in the Stadtwald include table tennis, soccer, beach volleyball, miniature golf and skateboarding.

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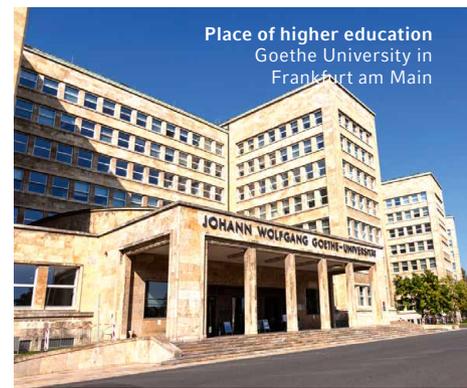
Historic Market place
The Römerberg with the
old Church of St. Nicholas
in the background



Relaxed and cozy
Going out and fine
dining in the district
of Alt-Sachsenhausen



Place of higher education
Goethe University in
Frankfurt am Main



2



THE FRANKFURT STOCK EXCHANGE is open to the public – provided reservations were made well in advance. Exclusive guided tours for individuals as well as groups (with a maximum of 70 participants, at a price of 125 euros) are available on all trading days at 7:45 a.m. (in time for the Opening Bell), at noon or at 3:30

p.m. The 1.5 hour long program includes a presentation on the history of the Frankfurt Stock Exchange as well as commentary on the actions taking place on the floor which visitors may view from the gallery. Important: you must remember to bring valid photo ID.

bit.ly/2Ey3m6c

3

Narrow alleyways, cozy squares, timber-framed houses and wells – Old Sachsenhausen, with its Große and Kleine Rittergasse, the Paradiesgasse and Klappergasse, is a traditional quarter full of characteristic **FRANKFURT COZINESS**.

This is where the Äppelwoi restaurants congregate: one sits on wooden benches and drinks the Hessian cider from the “ribbed”, the traditional apple wine glass that is faintly reminiscent of a mustard jar. It is best enjoyed with Frankfurt specialties such as beef with green sauce, “Handkäs” (sour milk cheese) with or without music, and pretzels.

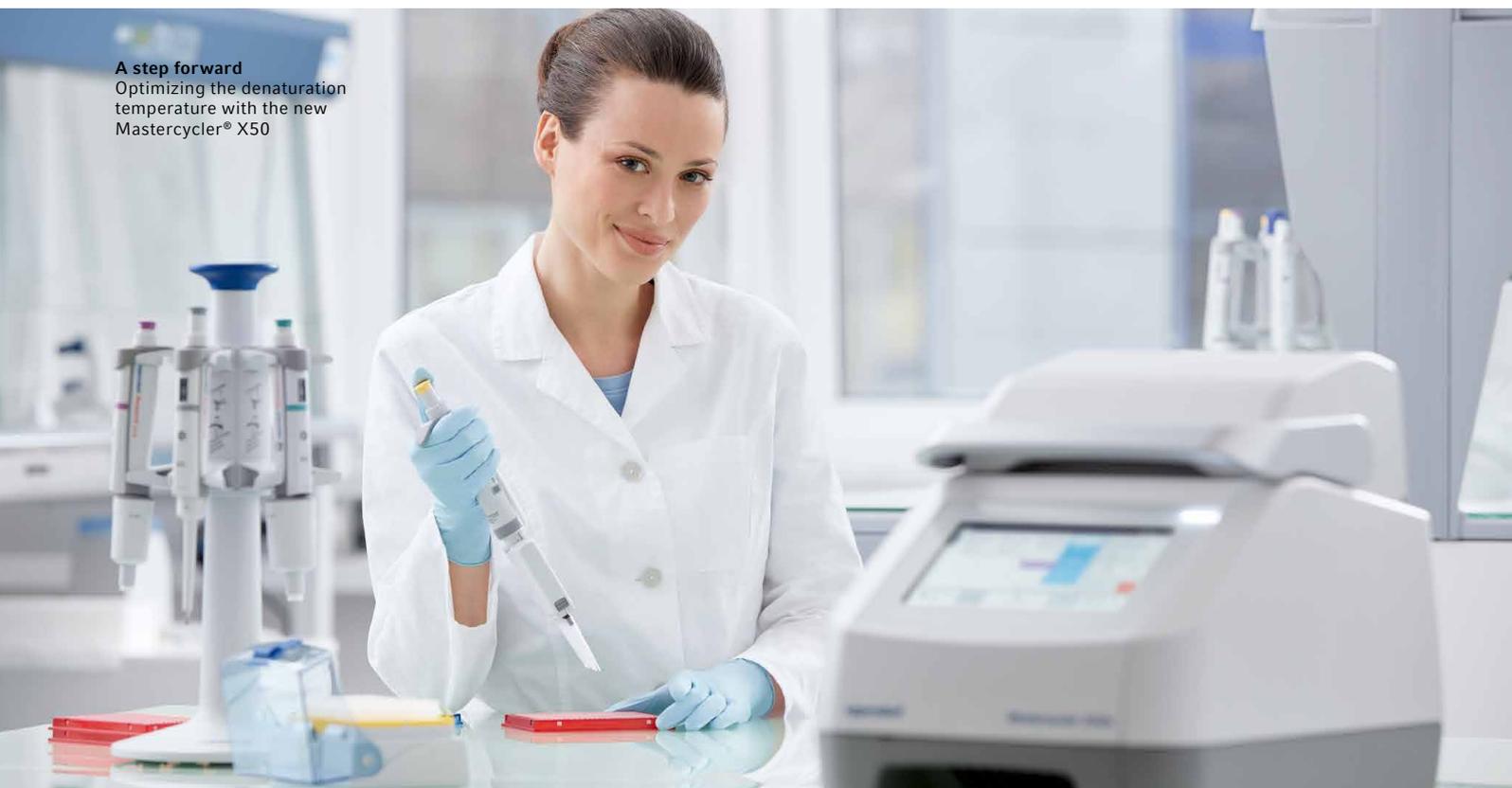


Help!

It's All in the Temperature

95 degrees Celsius – that is the denaturation temperature commonly recommended for PCR reactions. A new tool in the PCR toolbox now enables more flexible handling – for a higher yield.

A step forward
Optimizing the denaturation
temperature with the new
Mastercycler® X50



The toolbox for the optimization of PCR assays is well stocked: from primer design and magnesium concentration to new enzymes – these days, scientists have a number of options at their disposal. Optimization of the annealing temperature in PCR reactions, too, is a method that has been established for decades; it expanded the possibilities of PCR, and it paved the way for vastly more sophisticated assays and topics.

Furthermore, mastermixes and kits have become more efficient and less prone to error. Instead of taking days or even weeks, a simple PCR reaction can nowa-

days be established in a matter of a few hours or even minutes. Despite these advances, not all PCR assays meet with immediate success; even after experimenting with a series of different annealing temperatures, some assays simply will not produce DNA on a logarithmic scale.

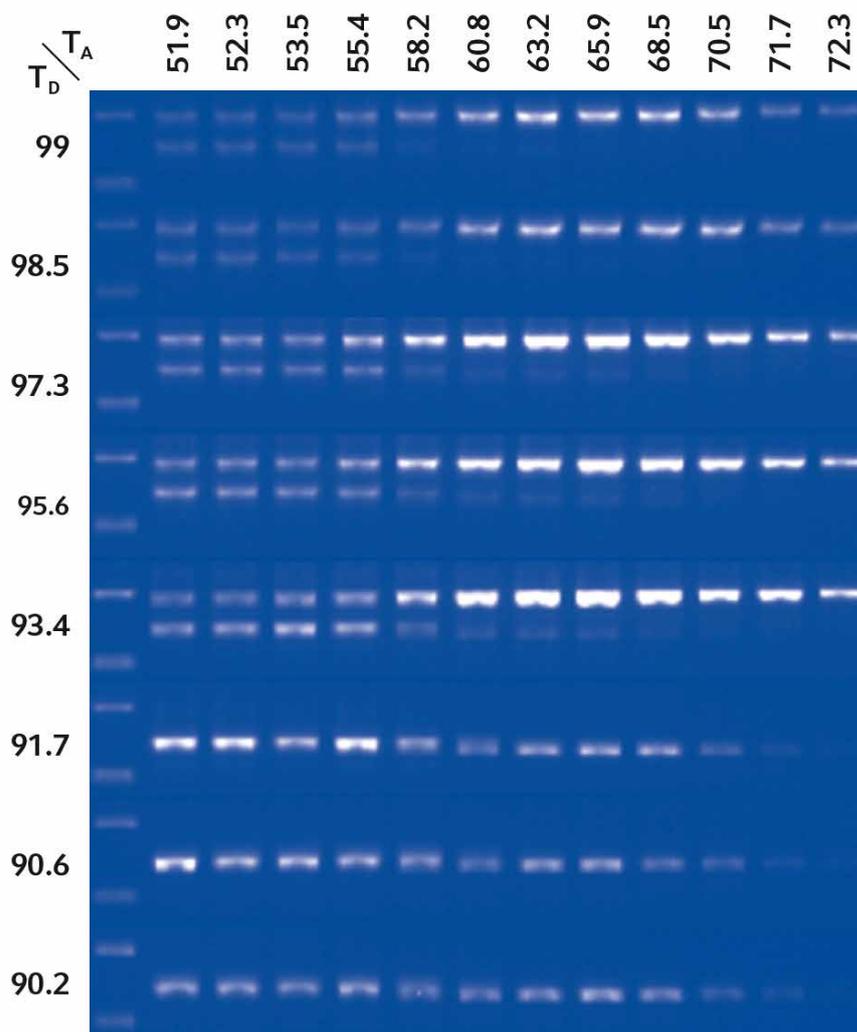
Crucial factors: inhibition and denaturation

One widely known reason for this failure is PCR inhibition: a number of substances are capable of inhibiting PCR, either by binding to the polymerase or by binding to the DNA. The latter category, in particular,

presents problems since the inhibiting substances are often purified alongside the DNA, i.e. they emerge from the purification process bound to the DNA and thus automatically enter the assay.

A less well-known factor, which will also lead to unsatisfactory DNA yield, is insufficient denaturation of the DNA. The majority of assays simply provide a denaturation step of 95 degrees Celsius – independent of the properties of the template DNA. Whereas the duration of the 95 degrees Celsius denaturation step may vary, it does appear as though temperatures beyond this limit, for the purpose of more efficient denatur-

2D-gradient optimization
Optimization of the denaturation (bottom to top) and annealing temperatures (left to right) allows ideal conditions for maximum yield or specificity



ation, were uncharted terrain to scientists. Once one knows how the denaturation process functions, it is conceivable that the length of the template, its GC-content, or the tertiary structure of the DNA must have a significant influence on the denaturation temperature required. A higher denaturation temperature, however, goes hand in hand with increased thermal stress on all biomolecules within the reaction, and it is therefore often not even considered.

Success factor temperature adaptation

One must always keep in mind that PCR constitutes a biological system: in a classic denaturation step, some template molecules of double-stranded DNA will separate while others will not. This circumstance may have a significant impact on the efficiency of the PCR, particularly during the first few cycles. If one envisions the heterogeneity of the DNA templates which form the basis of any PCR reaction, it is surprising that the majority of scientists are content with 95 degrees Celsius. Varying only the duration of this step, but not the actual temperature, will not always lead to the desired success.

As molecular biology advances into ever more ambitious topic areas and experiments, successful outcomes of challenging PCR reactions are essential. For this reason, a higher yield within the first few cycles especially may be crucial in order to kick-start the reaction into the logarithmic scale. The denaturation temperature appears to be the very variable which has not been used to the same extent as other variables within the PCR reaction.

A denaturation temperature which is too high will exert stress on all biomolecules. Depending on the enzyme, the half-life of the polymerases may be reduced by three to nine-fold at temperatures between 95 and 100 degrees Celsius. For this reason, unnecessarily high temperatures should be avoided in order to maintain the pro-

ductivity of the enzyme. That being said, it appears that under certain conditions, the tolerances of enzymes do seem broader. In the experiment depicted in the figure above, an increased denaturation temperature was followed by increased specificity of the assay, whereas the yield benefited from lower denaturation temperatures. Therefore, the denaturation temperature may be safely increased without running the risk of total reaction failure.

More flexibility through individual customization

Under such circumstances, optimization of the denaturation temperature may serve to steer the yield or the specificity of the entire PCR according to individual requirements. Using such powerful optimization strategies and the flexibility thus attained, the development of assays with a focus on better and more reproducible results is

simple. A temperature gradient function on your PCR cyclers, which may be utilized during the denaturation step, is capable of taking advantage of this additional optimization variable. The latest technologies even offer 2D gradients, where two temperatures, for example the annealing temperature and the denaturation temperature, can be optimized simultaneously during a single PCR run.

Optimization of the denaturation temperature therefore represents an additional tool in the toolbox that is available for difficult PCR assays. The glory of successfully mastering difficult PCR assays, and thus providing answers to novel questions, has now come within the reach of many researchers.

25 Years of Eppendorf BioNews

From a modest information booklet to a valued newsletter: Eppendorf BioNews celebrates its silver anniversary.

The year 1993 was a memorable year. Kary Mullis received a Nobel Prize for the invention of the polymerase chain reaction (PCR) he had made a few years earlier. Steven Spielberg's Jurassic Park® fueled fantasies about the revival of extinct animals such as dinosaurs using PCR and cloning ("Oh my God!"). And Eppendorf – admittedly a little less spectacular – published the first issue of its new customer magazine BioNews.

PCR as a biological technique for amplifying DNA has revolutionized molecular biology since its invention in 1985. Eppendorf was quick to spot its potential and developed a whole series of matching products for PCR labs. The first generation of Mastercycler® thermocyclers already allowed for short reproducible PCR cycles. Innovative Liquid Handling instruments and devices for PCR sample preparation and storage facilitated the PCR routine, while laboratory consumables in Biopur® quality met the highest purity requirements to prevent contamination.

BioNews was introduced to present these system solutions and new products in an objective and applicative context. At the time, it was merely more than an

exciting challenge in DIN A5 format with an unknown future of which no one thought it would once become the customer magazine that is, after 25 years, still regarded by readers as a highly popular source of information.

Workflow evolution

Lab methods and techniques have seen a significant development over the past years and so has the production process of BioNews. Compared with the situation today, the way BioNews was produced in the first years after its introduction resembles rather "cave art". Text manuscripts were exchanged using floppy disks with a storage capacity of 1.44 MB. Image data? Far from it! Valuable original diapositives were scanned and digitally edited in a laborious process.

From the end of the nineties, e-mails were used increasingly and, finally, exclusively for internal and external communication. Digitally created image data replaced scanning of diapositives and the now well-established PDF file format allowed exchange-



A title that endures 25 years have passed between the first issue of BioNews and the anniversary edition

ing layouts per e-mail and viewing and implementing corrections on the screen. What a simplification!

Outlook

CRISPR-Cas9, currently the "hottest" technology for genome editing, represents the greatest revolution in biology since the invention of PCR. For this method, too, users can rely on Eppendorf for suitable equipment, accessories and application support in the usual premium quality. Therefore: as long as life sciences develop or enhance exciting methods, Eppendorf will advance, too, in order to meet customer needs. Hence, we will have a lot to report on.

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Eppendorf AG with new Director

Eva van Pelt: New Chief Commercial Officer at the Eppendorf Group

"I am pleased to have the opportunity to accompany Eppendorf at such an exciting time and to join my fellow Directors and Eppendorf employees in leveraging new potential", stated Eva van Pelt on the occasion of her inauguration as a member of the Board of Directors at Eppendorf AG. On October 1, Ms. van Pelt assumed international responsibility for the areas of sales, marketing and service at the Eppendorf Group, which are bundled under the executive portfolio "Commercial Organization". Find out more about Ms. van Pelt in the link provided below.



<http://bit.ly/2obDW8y>



Centrifuges Manufacturing

Eppendorf has been manufacturing high-quality centrifuges since 1964, and their popularity with users has steadily grown over those years. Today, Eppendorf is a household name for benchtop centrifuges. Since 1991, its R&D and production facilities in Leipzig, Germany, have played a major role in this ongoing success story. A new film on YouTube shows how the modern production methods, professional warehousing, highly qualified employees and a strong commitment to sustainability provide the basis for state-of-the-art products with renowned Eppendorf quality.

bit.ly/2qmNhho



reddot design award

Multi award-winning Pipette Carousel 2 from Eppendorf

In recognition of excellent product design of the new Pipette Carousel 2 Eppendorf was honored with the Golden Pin Design Award 2017, the German Design Award 2018 and the Red Dot Design Award 2018. Industrial Designer Kathlen Jost and the engineers at Eppendorf created a highly flexible system for up to six manual single or multi-channel Eppendorf pipettes. Each of the six holders can be mounted to the carousel in two orientations turned by 180 degrees to store all current and most predecessor instruments. The carousel keeps the pipettes safely stowed in an orderly manner, yet within easy reach.



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How fast and accurately can you pipet, store and centrifuge incoming samples? This is what the Eppendorf game "Master of Volumines" is all about. Demonstrate your lab skills on the Eppendorf Handling Solutions Website! Once you have mastered the game you can print your personalized certificate.



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Meet our New Product Highlights

Eppendorf is represented at many of the world's leading trade fairs with its latest product innovations. Here is an overview about our highlights.



BioFlo® 120 Bioprocess Control Station

The BioFlo 120 is the latest Eppendorf bench-scale bioprocess system for research and development. It is suitable for microbial fermentation as well as cell culture applications and features an extensive range of glass and BioBLU® Single-Use Vessel options. Ease of use and flexibility ensure the new bioreactor/fermentor serves the needs of scientists today and in the years to come – be it in academic, governmental, or industrial research settings.



CryoCube® F740 series

As life science revolves around the sample, sample safety is the core of this new freezer series. Basic freezer aspects such as box capacity, energy efficiency, and silence level are also improved compared to the well-known predecessor Innova® U725/ -G. The F740 “i” models are controlled by a touch screen, similar to the new Mastercycler X50 and the shaker S44i, enabling an intuitive and easy interaction. For remote performance monitoring, all F740 models can be connected with VisioNize.



ViscoTip®

Let it flow! The new member of the Combitips advanced® family is eager to master the really viscous liquids. Even liquid honey is not a challenge for the ViscoTip®. Save time by automatic tip recognition and volume calculation in Multipipette®/Repeater® M4/E3(x). Find the right tip instantaneously by distinctive color coding. Keep experiments safe without interfering leachables and slip agents. Get faster by aspirating once and pipetting many times.



Centrifuge 5910 R

Centrifuge 5910 R sets the next benchmark in versatility, capacity and user convenience. Cell harvests carried out in bottles up to 750 mL, large scale purification of DNA/RNA as well as Ficoll® gradients are just a few examples of the many areas of application served by this new centrifuge. Its new swing-bucket rotor S-4xUniversal and the universal adapters accommodate bottles, plates, and more 15 mL and 50 mL conical tubes than standard 3 Liter multipurpose centrifuges do. This speeds up your workflows and makes everyday work more efficient and enjoyable.



VisioNize®

The VisioNize system enables you to easily link your lab equipment to a central monitoring and data-management software. It is a smart network that lets you organize your lab equipment efficiently. Connect your lab devices to the central server application VisioNize core and remotely monitor the performance from your office PC or check the current status of your devices on the way with the mobile iOS app VisioNize go.

Mastercycler® X50 Family

The Mastercycler X50 family allows scientists to optimize PCR conditions like never before. 2D-Gradient technology allows optimization of annealing and denaturation temperatures – in a single run. Increased block control means we can do this while achieving unrivaled ramp rates -10°C/s . You can connect nine additional cyclers to a single cycler with touchscreen interface. The highly responsive interface makes programming and monitoring fast and easy. Best of all, you won't know it's running. It's quiet as a whisper – designed with you in mind.



Innova® S44i Biological Shaker

The latest addition to the Eppendorf shaker family – the Innova® S44i offers the highest culturing capacity of any shaker. Its groundbreaking new drive technology allows worry-free, reproducible shaking of heavy and uneven loads. Access all samples conveniently with the glide-up door and easy to slide out platform. It is engineered to deliver years of reliable operation!



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THE JOURNEY OF A

PAULA DE TEZANOS PINTO

I got pregnant at 38, not long after obtaining a permanent research position. Until that time, I had been a free and adventurous soul, working long hours and traveling frequently for my research on aquatic cyanobacteria. During the last three years of my PhD, I spent the summers in a lab in the United States, far from my home country of Argentina. I worked another full year in that US lab during my postdoc. Along the way, I managed to find love, settle down, and start on the road to becoming a mother. My sister, who had a kid of her own, warned me that my priorities were about to change. She said that, when my child was born, it was possible I would want to quit science and become a full-time mom. But I loved my work.

Enjoying two passions, motherhood and science

That was about five years ago. My daughter Julieta is now a cheerful kindergartner – and I am still doing science. To some extent, my sister was right. When Julieta was born, I quickly realized that she was the biggest adventure I had ever embarked on. But I was right, too. I did not want to give up my research. So, once my maternity leave was over, I had to figure out how to enjoy my two passions, motherhood and science, and embrace the pleasures and pains of their sometimes conflicting demands.

One of the biggest adjustments I needed to make was my approach to travel – though I didn't realize it right away. When my daughter was a year old, I won a grant that involved spending a month working in a lab in the Czech Republic. I was very excited about the research I would be doing there, but I did not want to be separated from Julieta for that long, so I decided to bring her with me. I naïvely thought this trip would be similar to past ones,

when I had traveled alone. This time, I planned for a babysitter to cover my working hours and thought that would take care of it.

But when I arrived, the babysitter turned out to be much less available than I expected. I had traveled so far to conduct my research, but instead I was spending much of my time taking care of my daughter. I was frustrated, and at the same time, I felt guilty that I wanted to work instead





“
I had to figure out
how to enjoy my two
passions, motherhood
and science.”

Paula de Tezanos Pinto is an investigator at Argentina's National Scientific and Technical Research Council and the University of Buenos Aires.

SCIENTIST MOTHER

of be with my child. Soon, I broke down in front of my Czech colleague, who graciously helped me work out an alternative babysitting solution.

Even with the child care worked out, I faced other challenges. When traveling, I was used to working without paying attention to the clock. During this stay, however, I ended my workday much earlier

than I was accustomed to so that I could go home to my daughter. At first, I wasn't sure I would be able to complete my work with this schedule. But I shouldn't have worried: I worked happily and productively during the day, and then I picked up my daughter so that we could stroll through the beautiful autumn colors. By the end of the trip, I had accomplished everything I had planned.

Believing that a happy mother is a good mother

Even so, after this experience I knew that I needed to change the way I travel for work. I now choose my trips carefully and plan the logistics far in advance. I travel alone, for fewer days, less frequently, and to locations closer to home. I know that Julieta misses me when I'm gone, and I miss her, too. But I am happy pursuing my goals, and I believe that a happy mother is a good mother.

Sometimes I miss the freedom I once had to leave for a trip at a moment's notice. Yet Julieta adds happiness, diversity, and

complexity to my life, which helps me be more creative. I have learned to maximize the golden hours of focused work and to plan ahead while also being flexible. Having Julieta also forces me to stop working sometimes, which helps me avoid burnout. And I have learned that I can ask others for support, both in life and in work. So, despite all the challenges, I am happy to be a mom and a scientist, and I am enjoying the journey. ■

INFOBOX



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Welcome to My Humble Abode

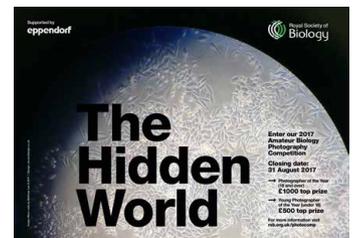
It must have been the love of detail that convinced the jury of the “Royal Society of Biology amateur photography competition”. Duncan McNaught, with his photograph “Fungi and Insect”, was awarded the title “Photographer of the year 2017”.

About the photograph and its master



“Living in rural Dumfries and Galloway I have access to some amazing landscapes, Flora

and Fauna but it’s the smaller often overlooked plants and insects that really spark the creative photographer in me. Some of the forests in my area are pretty inaccessible due to their wet boggy nature, however its these hidden, sometimes, magical places I find myself more often than not lying flat on the ground photographing mosses, fungi and insects, all waiting to be discovered and mostly unseen by today’s hectic society. It certainly presents me with many challenges but hopefully my passion for our hidden world will encourage others to explore.”



CAPTURING THE HIDDEN WORLD

The theme of last years’ Royal Society of Biology amateur photography competition was “The Hidden World”. Supported by Eppendorf since 2012, the competition invites photographers to submit their pictures and compete for the title “Photographer of the Year” (18 and older) and “Young Photographer of the Year” (under 18).



Coleman on Fire

The photograph by Dheeraj M. Nanda was another favorite of the jury of the “Royal Society of Biology amateur photography competition”. “It’s a great honor to win the Young Photographer of the Year Award”, says the underwater photographer.

About the photograph and its master

“While I was diving in the macro heaven of Ambon, Indonesia my guide pointed me towards small critters moving on a fire urchin. It took me a minute to recognize this shrimp and it was an awe-inspiring moment to me, as it was the first time I saw these creatures. The Coleman shrimp and fire urchin here share a symbiotic relationship where the Coleman shrimp seeks refuge among the spines of the urchin. There are plenty of microscopic critters beneath the sea surface and they never cease to impress us. I’ve always felt that these creatures should not be unnoticed and showcasing their images in these events would do justice to their beauty.”







The Next Benchmark

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