

Off the BENCH

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MAN AGAINST THE MACHINE?

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THE INTESTINE: THE BODY'S CENTER

What does our microbiome have
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presented by
eppendorf

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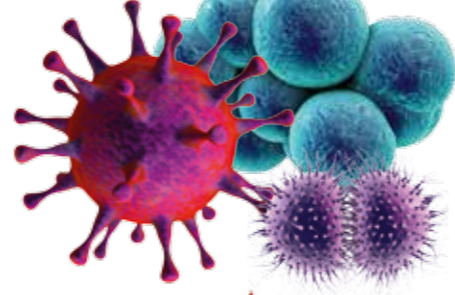
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MASTHEAD

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Editorial



Dear Reader,

Outstanding scientific achievements are always also an expression of a functioning team. Only when all involved parties pull together, groundbreaking discoveries become possible which will help us shape the future. Andrea Ablasser, winner of the Eppendorf Award for Young European Investigators 2018, acknowledged exactly that: "I am greatly honored to receive the prestigious Eppendorf Award. It recognizes the contributions of several gifted colleagues and students, who all took part in this long, but exciting research effort", she said on the occasion of the award ceremony which took place in Heidelberg in June of last year.

The prize offered jointly by Eppendorf and the scientific journal Nature has been recognizing outstanding work by young graduates in the field of biomedical research since 1995 – the latest being the engagement of the 35-year-old German immunologist who is studying the secrets of our immune system in in Lausanne, Switzerland. We are pleased to introduce her in our career portrait.

A further award winner is introduced in our news pages: in 2018, Johannes Kohl won the 17th international Eppendorf & Science Prize for Neurobiology, which we present in collaboration with the scientific journal Science. It is no coincidence that Eppendorf is engaged in not one, but two, awards. We have always been committed to fostering close contact with the

community of young scientists and to promoting and supporting world class research in its beginnings. The young German scientist convinced the jury with his Harvard University-based work on neural mechanisms that form the basis of parental care. Later this year, Johannes Kohl will establish his own research group at the Francis Crick Institute in London.

A lot has happened in the world of science. In this edition of Off the Bench, you will enjoy a front-row view and witness new developments, surprising facts and trend-setting ideas. Our special recommendation: the interview with Dr. Ulrich Eberl on the topic of artificial intelligence.

We hope you will enjoy the read,

Eva van Pelt
Member of the Management Board
Chief Commercial Officer

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www.eppendorf.com/otb

Science News

An animal's influence
The settlement of wolves will always effect changes in the ecosystem

When the Wolves Came ...

Ever since the resettlement of roughly 30 wolves into Yellowstone National Park more than 20 years ago, the park's ecosystems have changed more dramatically than previously anticipated. Whereas previously moose had been the predominant herbivores, their population has since declined, leaving room for other animals, such as bison, to thrive.

The resulting changes in foraging and feeding behavior displayed by these species have influenced the vegetation in the National Park on a large scale: the

populations of willow, poplar and aspen in particular were able to recover substantially. "We would have never seen these responses if the park hadn't followed an ecological-process management paradigm allowing natural ecological processes to take place with minimal human intervention," says Professor Mark Boyce, ecologist and study author from the University of Alberta in Canada, in a statement. He notes that these results might not necessarily be repeated in other systems, namely due to the influence of humans.



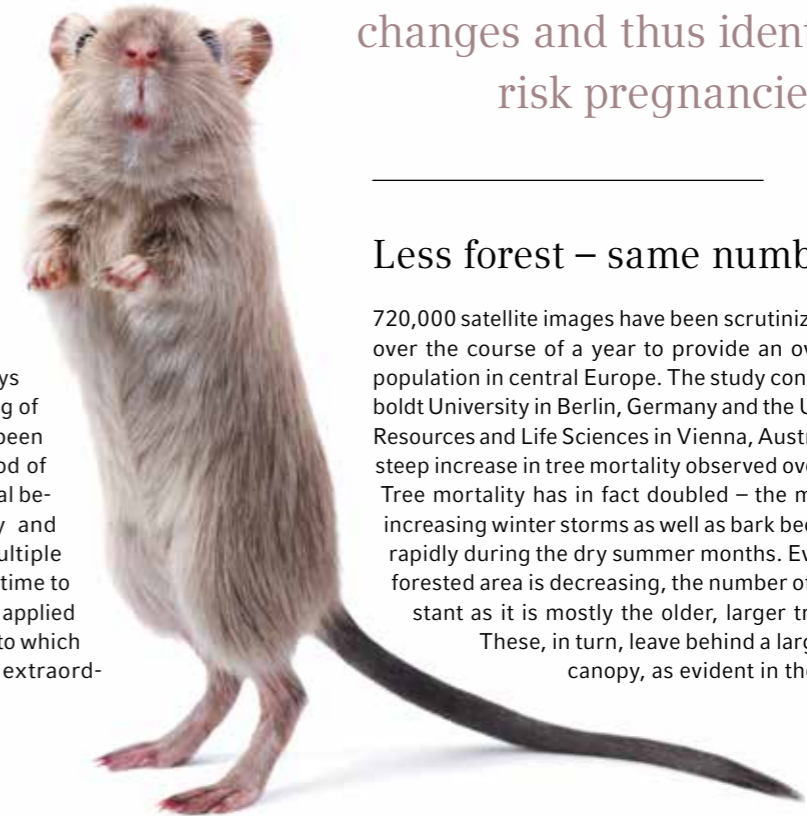
Breathe in, breathe out – detecting cancer

Detecting cancer early and as accurately as possible forms the basis of any successful therapy. British researchers are currently working on bringing a novel breath-biopsy technology to market. Their idea has matured to the point that a large clinical trial is now possible. To this end, breath samples will be taken from 1,500 patients diagnosed with different types of cancer and analyzed.

The idea is not entirely new, but the researchers at Cancer Research UK Cambridge Centre and Owlstone Medical are pursuing a different approach: they aim to identify molecules called "volatile organic compounds" (VOCs) that are linked to the presence of certain tumor types and which can be detected in the exhaled breath of patients. Preliminary results are expected in 2021.

The nicotine fallout transmissible through sperm

Nicotine's negative impact on offspring is not limited to uterine transmission during pregnancy and passive smoke inhalation. According to a study conducted at Florida State University, paternal sperm also plays a role. For example, the offspring of male mice that had previously been exposed to nicotine over a period of three months displayed abnormal behaviors such as hyperactivity and learning difficulties across multiple generations. It is unclear at this time to what extent these results may be applied to humans, as the nicotine dose to which the mice were exposed was extraordinarily high.



16,000

genes of pregnant women were compared between the early and the late stages of pregnancy. According to this American study, more than 400 genes displayed altered activity. The results could help detect abnormal genetic changes and thus identify high-risk pregnancies.

Less forest – same number of trees

720,000 satellite images have been scrutinized by five scientists over the course of a year to provide an overview of the tree population in central Europe. The study conducted by the Humboldt University in Berlin, Germany and the University of Natural Resources and Life Sciences in Vienna, Austria, investigated the steep increase in tree mortality observed over the past 30 years. Tree mortality has in fact doubled – the main causes include increasing winter storms as well as bark beetles which multiply rapidly during the dry summer months. Even though the total forested area is decreasing, the number of trees remains constant as it is mostly the older, larger trees that are dying. These, in turn, leave behind a larger gap in the forest canopy, as evident in the satellite images.

On Patrol with the Immune System

RESEARCH CAREERS

At EPFL® in Lausanne, Switzerland, German immunologist Andrea Ablasser is looking for answers to the question of how the body's own immune cells recognize pathogens and how, if necessary, these immune cells eliminate them. She is very close to achieving her goal.

“

It is found throughout our bodies, but nobody can see it – not under the microscope, and not even with the help of the most modern imaging equipment. The immune system is a clever complex of cells that has the power to kill us within minutes, for example, during an allergic reaction. It is also capable of granting us a lifetime of good health. Like policemen on watch, its trillions of team members patrol the tissue, organs and blood vessels, and they defend all points of entry in the skin and the mucous membranes against pathogens – as this is where the daily onslaught of viruses, fungi and parasites clamors for entry.

It is this network of messenger substances, receptors and cells that has captured Professor Andrea Ablasser's scientific heart. At L'École Polytechnique Fédérale de Lausanne (EPFL), the immunologist and native of Bad Friedrichshall in Germany deciphers the immune recognition that is integral to the body's defense against pathogens. For centuries, generations of researchers have attempted to understand this complex system of defense. Despite considerable success, however, it is still holding on to many of its secrets. Andrea Ablasser, too, is intent on solving the mysteries, and she has come very close to achieving her goal. Her research on the innate immune system has inspired the international scientific community, and it has earned her numerous awards – the most recent being the Eppendorf Award for Young European Investigators 2018, which is awarded annually to extraordinary researchers.

Improving disease treatment

The 35 year-old medical doctor is indeed extraordinary: at a little over 5'3", with a slight build, she is a mental heavyweight. With willpower enough for two, she pursues the unknown; she wants to discover and uncover, analyze and evaluate and thus contribute to better treatment options for diseases ▶

Basic science

Andrea Ablasser is determined to further the understanding of the human immune system and to find answers to age-related diseases



such as dementia. “I want to create something that can be useful.”

Andrea Ablasser is humble. Being the center of attention and receiving honors makes her feel self-conscious. She much prefers working in the laboratory, loading centrifuges, filling pipettes, isolating viruses and letting them loose on different cell types. Experimenting and tinkering are her passions.

“Basic science is my calling – it is what I enjoy”, emphasizes the otherwise pragmatic researcher. The fact that this much “fun” leaves little room for spare time is not a big problem for Andrea Ablasser. “After all, work for which one is predestined, which is so completely satisfying, isn’t work at all”, she says, and she has another ace up the sleeve of her white lab coat: her partner Tobias Kippenberg, professor of physics, shares her passion for time-intensive research. Time management is therefore not an issue in the Ablasser/Kippenberg household. Science first!

Of basic police and special forces

Andrea Ablasser is a person of few words. She prefers listening to speaking – unless the topic is science. She then inhales deeply and praises signaling cascades and the talents of cGas and STING. These two molecules are in fact the heart and soul of her research. “Our body’s immune system has developed two mechanisms with which to combat pathogens”, the young professor explains enthusiastically: “non-specific innate immunity and specific acquired immunity.” The innate immune cells do the work of the basic police. They are always on call; they act in the face of danger, and as phagocytic cells or natural killer cells, they eliminate pathogens. If the innate immune system becomes overwhelmed, it will call to the scene the arm of the immune system that the body has acquired over the course of its life – the special forces. Their antibodies must be produced first, but once ready, they are then custom-tailored to the enemy.

Within her research project, the scientist and her team of twelve study how the innate immune system recognizes pathogens, and

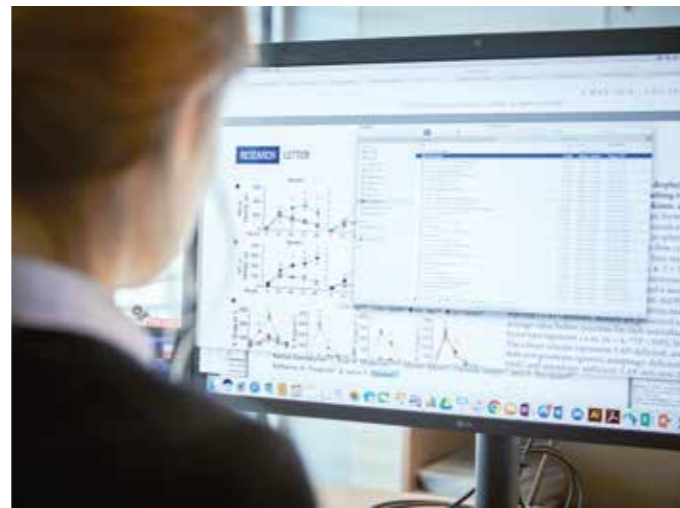
the consequences of such recognition: “We are particularly interested to know how viruses and bacteria are recognized by their DNA inside the cells.” The focus is on a certain signaling pathway that consists of two molecules, cGas and the adapter molecule STING. This signaling cascade inside human cells was discovered only ten years ago. “If both molecules are activated, an inflammatory reaction will result that is important for combating viruses as well as specific types of tumors.”

In some cases, this signaling pathway will start up in error. This is the case when, through stress, cellular aging or illness, the body’s own DNA escapes from the nucleus and the DNA sensors respond in error. Fatal consequences may ensue: “The mistake may lead to a vast number of illnesses such as chronic inflammation, autoimmune diseases and neurodegenerative conditions”, says Ablasser.

Two small molecules with great potential

Based on this knowledge, the scientist has embarked on the search for a substance that suppresses the immune activation. She was successful. “In a screening process involving more than 60,000 molecules, we came across two promising small molecules that were capable of switching off the

signaling pathway in a highly specific manner.” The team has been able to demonstrate in human cell lines as well as in mice that this inhibitor is indeed capable of preventing an autoimmune reaction. Andrea Ablasser is hopeful that this inhibitor will be developed further and in the future will be of use in the clinic. “Perhaps for the therapy of diseases of the immune system, but also for the therapy of illnesses which are much more common, such as heart attacks or Parkinson’s.” The potential of this inhibitor is now to be tested in a number of different disease models, and Andrea



Researching knowledge
Capturing facts, analyzing data, recognizing new connections



Lab work
At EPFL in Lausanne, the immunologist deciphers the immune recognition which drives the defense against pathogens



It is my goal to better understand age-related illnesses such as lung fibrosis or the loss of hematopoietic stem cells.”

Ablasser has recently co-founded a start-up for this purpose.

Determination and consistency make up the common thread of the life of this resolute scientist. “Even as an adolescent it was my wish to become a scientist.” In high school she skipped a grade and eventually followed the study of medicine at such renowned universities as the University of Oxford, Harvard Medical School and Ludwig-Maximilians-University in Munich. She has come by her enthusiasm for medicine honestly, through her father, chief physician at the hospital in Buchloe in Eastern Allgäu in Germany. “His work fascinated me, and it made a lasting impression on me”, she remembers. In her doctoral thesis, the aspiring scientist focused on immunology, and in 2010 she earned her doctorate in clinical pharmacology.

Living the science

Following her doctorate, she continued her research in the field of innate immunity at the Institute for Chemical and Clinical Pharmacology at the University of Bonn. In 2014, Andrea Ablasser was appointed Professor at EPFL in Switzerland and thereby hit two birds with one stone: the passionate skier was back where she felt most at home – in the mountains. While she no longer participates in downhill ski races, the nature lover gets around on her road bike. Secondly: she no longer has to maintain a long-distance relationship and is able to live with her partner. And what is next? Entrepreneurship in her own start-up instead of science?

“Absolutely not!” Andrea Ablasser remains true to basic science and she can already envision a new riddle that needs solving: the connection between cellular aging and innate immunity. “It is my goal to better understand age-related illnesses such as lung fibrosis or the loss of hematopoietic stem cells.” After all – as her career leading up to today clearly shows – basic understanding of cellular processes is an important step in the cure of disease. ■

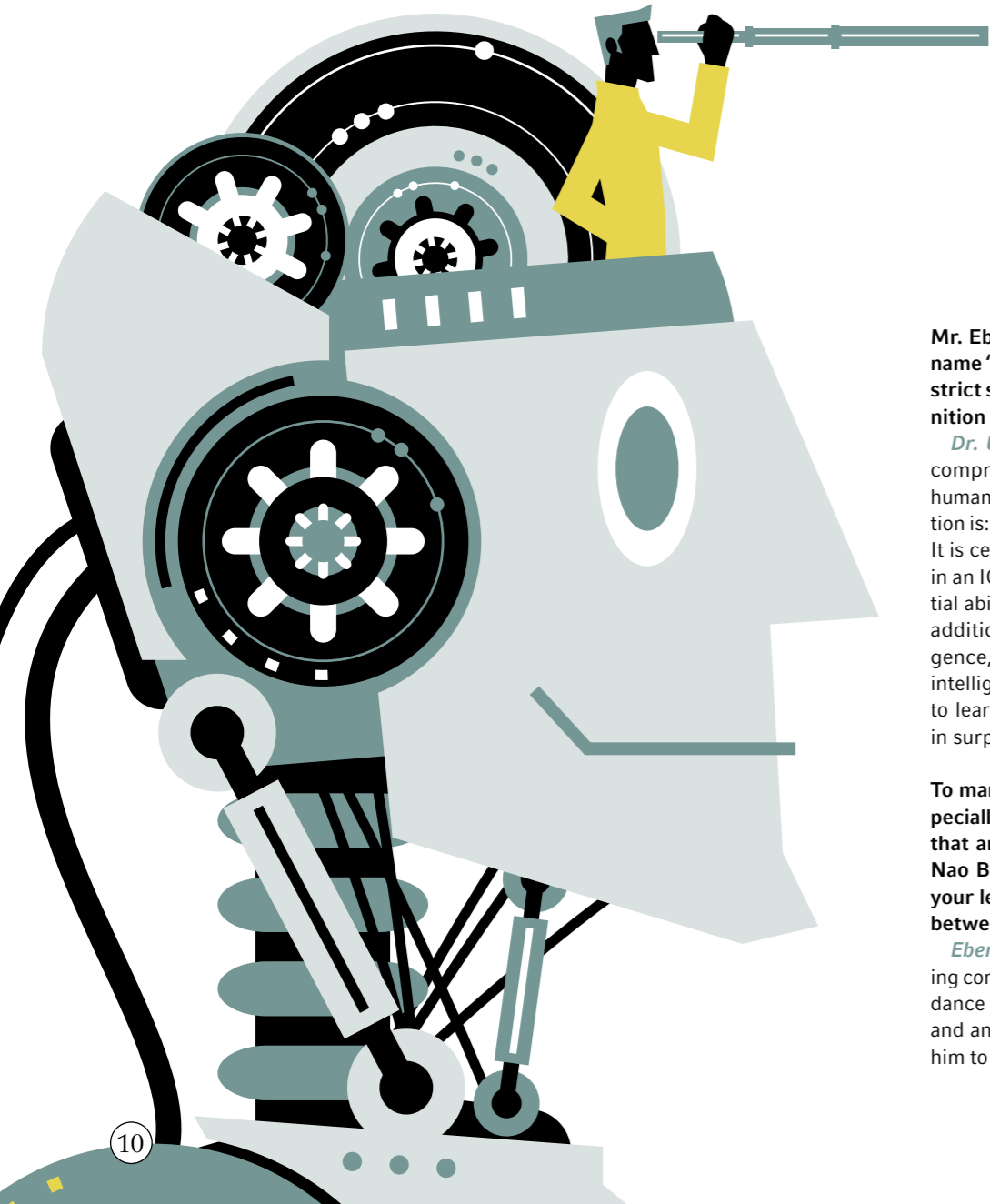


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Science Facts, not Science Fiction

Artificial intelligence is on the rise. In this interview, Dr. Ulrich Eberl explains where machines already surpass us – and the limits within which they operate.



Mr. Eberl, not everything that bears the name “Artificial Intelligence” fits into the strict sense of this category. Which definition do you consider valid?

Dr. Ulrich Eberl: Artificial Intelligence comprises all technologies that recreate human intelligence in a machine. The question is: what is the basis of our intelligence? It is certainly more than can be measured in an IQ test, such as logical thinking, spatial ability or language comprehension. In addition, there are sensorimotor intelligence, emotional intelligence and social intelligence – and, importantly, the ability to learn and come up with new solutions in surprising situations.

To many, the topic remains abstract, especially in light of the futuristic scenarios that are associated with AI. Your robot Nao Bluestar often accompanies you to your lectures. Does he serve as a bridge between technology and humanity?

Eberl: My little robot is indeed an amazing companion. He is ticklish, he can laugh, dance and play soccer; he can cite Hamlet and answer questions. I have even taught him to order a pretzel at the bakery and to

toast my book “Smart Machines” with champagne. Still, I would not consider him intelligent – he does not learn and he does not understand any of the things he does.

Being so cute, Nao appears completely harmless. Nevertheless, AI frightens many people. Are there not areas in which machines already outperform us?

Eberl: Indeed, more progress has been made since 2012 than during the preceding 50 years – today, each smart phone has the capacity of a supercomputer from 25 years

ago, and machines are capable of learning independently from example. With each language input and each search command, computers and robots get better at understanding spoken language, texts and images. The best systems beat human world champions at Jeopardy as well as at the board game Go; they make half the number of mistakes as humans when it comes to recognizing traffic signs; they outperform radiologists in the identification of tumors – and they are better at reading the emotion in a face than many people. Moreover: their computational power is predicted to increase a thousand-fold by 2040 – at stable cost.

“

They may be capable of composing like Bach and painting like van Gogh, but they cannot invent something entirely new.”

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Isn't that reason enough to fear superintelligence?

Eberl: Even the smartest machines will continue to be “one-track specialists” for a very long time – an expert in one area, and nothing more. They are perfect at pat-

tern detection: reading and analyzing text, analyzing images and language, finding errors, categorizing items. What they lack is an understanding of our world, intuition and empathy. They are devoid of emotional and social intelligence, and they are not creative. They may be capable of composing like Bach and painting like van Gogh, but they cannot invent something entirely new. Machines that surpass humans in all areas belong in the realm of science fiction, not scientific fact.

Some studies predict that AI will destroy up to 50 percent of today's jobs. Others point towards its potential. Which perspective do you consider realistic?

Eberl: I believe that all jobs will be subject to massive change – from the taxi driver to logistics specialists and laboratory assistants, accountants and financial advisors. Machines will take on more and more routine tasks, particularly in offices. This does not mean that these jobs will become obsolete; instead, they will increase in complexity. Humans will still be needed: as planners and decision makers, as those who ensure quality and security, as sales people and motivators, as creative problem solvers and mediators of conflict. At the same time, new jobs will emerge, for example, instructors of machines who will ensure that these machines do not learn the wrong material, as well as data security and privacy professionals, as AI does open the door to entirely new types of threats.

This means that a considerable number of bright minds are needed. AI experts are rare, and they are in demand. Are we thwarting ourselves by not investing enough in research?

Eberl: It is true that particularly the US and China invest three to five times more in AI than Europe does. Even so, our research is excellent. There is a reason that US companies prefer recruiting experts from Europe. At the same time, cooperation between institutions and business, education and training, as well as European coordination and legislation, must be improved considerably in order to ensure that we will be able to play to our strengths.

!



Dr. Ulrich Eberl, born in 1962, earned his doctorate in biophysical chemistry from the Technical University Munich in Germany; he worked at Daimler, and at Siemens he spearheaded communication on research, innovations and future trends for 20 years. In 2015, he struck out on his own as a book author and keynote speaker. His current book “Smart Machines – how Artificial Intelligence is Changing our Lives” is the result of several months of research at leading institutions and firms in Japan, the US and Europe.

Particularly the areas of transportation, the chemical and the pharmaceutical industries, as well as mechanical engineering and electrical engineering – those fields in which we are global leaders – present exceptional opportunities for AI.

AI is therefore more than a passing hype?

Eberl: Yes, we are only at the beginning of the era of the smart machine. Using smart factories and smart offices, companies will be more flexible and more competitive. Smart cars give us automated driving; smart grids are needed for sustainable energy systems; smart homes for comfortable living in old age; and smart cities for livable cities. I believe that this is a vision worth pursuing. ■



The Business of Science

Danger:
fake publisher!
Published quickly,
lost it all – caution is
of the essence when
it comes to scientific
publications

Entering the keywords “science fake” into an Internet search engine will yield 760 million results. The phenomenon of fake science publishers has swept the globe.

average four invitations per month for the past year. The number and frequency alone make it clear that something cannot be right. The clinic administration has now issued a warning regarding such e-mails”, says this head of a special outpatient clinic.

Predatory publishers operate without quality assurance

According to the US expert on scientific communication Jeffrey Beall, the AASCIT, similar to a number of other companies, is therefore considered a predatory publisher. A predatory publisher is a so-called open access publisher that assumes the model of traditional scientific publishers by promising scientists a speedy publication under a scientific sounding name, including (feigned) quality assurance. According to a research network, roughly 400,000 researchers worldwide have taken advantage of such a service. They either fall into the trap through the e-mails, or they knowingly use the option of open access journals to extend their publication lists.

The fact that the elimination of quality assurance (the peer review process) paves the way for content that would not ordinarily stand up to serious scrutiny was elegantly demonstrated in an experiment conducted by journalists Svea Eckert and Peter Hornung in 2018. “We are starting a scientific career” was the opening episode of their six-part podcast “Fake Science”, which was broadcast on public television. The two adopt pseudonyms with doctorate degrees and set up corresponding e-mail addresses. They then generate a meaningless text that discusses a made-up algorithm called MOP, the footnotes of which reference non-existent literature. The article is then submitted to the publisher “World Academy for Science, Engineering and Technology” (WASET). “Only a few days later, we received a ▶

On Saturday, December 15, 2018, at 7:16 am, Psychologist Saskia Fahrenkrug receives an e-mail with the subject line “Send Your Manuscripts to AASCIT Journal of Psychology”. The letter invites the staff member of the Clinic for Child and Adolescent Psychiatry at the University Clinic Eppendorf in Hamburg, Germany, to publish an article in a journal of the American Association for Science and Technology (AASCIT). “At first glance, this sounds delightful; after all, a scientific reputation is based first and foremost on one’s publication record – which is, as a rule, difficult to fill”, says Saskia Fahrenkrug. At the same time, the mail is disconcerting. It does appear valid due to the personal address, as well as its references to past publications. At the same time, however, the question arises whether it could really be that easy to have a paper accepted for publication. To add to the confusion, invitations from publishers flood the inboxes of some scientists like spam – including offers to serve as keynote speakers or speakers at conferences. “I have received on



response: we were asked to add three sentences to the introduction as well as a footnote. That was it. Apart from that, WASET appeared to find nothing wrong with our paper. We were invited to present the nonsense at an upcoming conference in London.”

The desperation of the researchers

It is the world of pseudo-scientific publishers and conferences that the two journalists are entering with their research. In this illusory world, publishers make money from the desperation of the scientists who must publish their results somewhere. “Those who do this once are victims. We believe that this comprises the largest group”, Peter Hornung emphasizes in a commentary on German public television (NDR®). “There is, however, a second group: those scientists who publish multiple times in fake journals. In this dubious underworld, they meet the third group: the charlatans and the quacks, the profiteers and the crooks that need a scientific seal of approval for bad products, dubious medications or far-fetched theories. At the end of the day, a noteworthy crowd has congregated: good science, mediocre science and bad science – as well as fake science. Nobody knows who did what.”

To the detriment of science

The credibility of science is thus in peril. According to the former librarian of the University of Colorado®, Jeffrey Beall, who published his “Beall’s List of Predatory Journals and Publishers” online between 2008 and 2017, when certain publishers threatened him with libel action, the damage to academia is immeasurable. “Because the predatory journals will publish

almost anything in exchange for money, they do not carry out a bona fide peer review and often publish junk science. If someone has a pseudo-scientific agenda, he or she can easily publish articles in bogus journals that look authentic, articles that promote fake medicine, articles that deny global warming, articles that claim vaccines cause autism, or articles promoting the chemtrails conspiracy theory”, he says. “In short, science is now easy, and anyone can publish an article promoting any scientific idea, regardless of how crazy or false it is. Predatory open-access publishers have completely poisoned scientific communication and the future of science itself.” ■



If I were contacted by a publisher, I would always conduct background research. Even if, and especially if, the e-mails refer directly to an article that I have published.”

Interview

Professor Tolg, you are Head of the Commission for the Safeguarding of Good Scientific Practice at your university. The German Research Council has declared the commission an instrument of academic self-regulation. How strongly are you confronted with the topic of researchers being led astray by pseudoscientific publishers?

Boris Tolg: At our university, two people have registered to attend a pseudo-conference; in the end, however, they did not travel. In general, the actions of pseudo-publishers have become increasingly aggressive over the past few years, and this poses a serious problem.

How do you ensure that the work at your university is conducted in accordance with scientific criteria?

Tolg: At our institution, the Commission for the Safeguarding of Good Scientific Practice engages a two-step process: three ombudspersons serve as contacts for those who wish to report scientific misconduct. The ombudsperson then conducts preliminary investigations, and, in the case of a violation of Good Scientific Practice, the ombudsperson will report to us. We also speak with witnesses and, if required, we will investigate the work that is in question. In our final report to the president, we will also document recommendations for action.

And how do you and other universities arm yourselves against predatory publishers?

Tolg: Some universities offer information seminars on the topic. Our Administrative Department for Research and Transfer imparts to graduate students

what it means to work with scientific integrity – including the question of how and where to publish the results of one’s research. In addition, we are currently in the process of designing a new look for the Commission for the Safeguarding of Good Scientific Practice on our website. The thought of publishing a black list is a part of the discussion – personally, though, I am always careful when it comes to erecting pillories.

Which alternatives are you considering?

Tolg: Perhaps a checklist could help determine whether a publisher employs dishonest methods. If, for example, a scientific journal or a conference lacks a scientific focus, caution is of the essence. Those who are unsure are well advised to speak with colleagues or to contact the appropriate commission at their university.

What else could one do?

Tolg: The Hirsch index puts the number of publications of an author in relation to the number of times this work has been cited. The number increases as I publish new work that is then cited by other authors. If work published in predatory journals were prohibited from being cited, it would have an automatic impact on the Hirsch index and could thus limit the popularity of pseudo-journals. Since the Hirsch index is frequently calculated with the help of online tools, such an idea could easily be put into practice. Further, articles that were published with the help of pseudo-publishers should disappear from one’s own publication record. ■



Boris Tolg is a Professor of Computer Science/Mathematics at the University of Applied Sciences Hamburg, and he serves as Head of the Commission for the Safeguarding of Good Scientific Practice at his institution.

Global Beauties

Cosmetics firms send their scientists out into the world for the purpose of researching ethnic personal care traditions. The discipline goes by the name Geocosmetics, and its goal is the development of custom-tailored products.

Japanese women require approximately 100 brush strokes to give their relatively short eyelashes the proper curl. French women, on the other hand, are “très chic” after only 50 brush strokes. Italians prefer to lather themselves with a perfumed bar of soap, whereas Germans favor a shower gel from the bottle. Last, but not least, Mexicans are the world champions when it comes to the consumption of hair gel.

Whereas the different care and beauty rituals are for the most part governed by genetic as well as cultural factors, regional climate and traditional habits also influence behavior in the bathrooms of the world. In order to be able to customize their products to the different needs and desires, international cosmetics companies research local ethnic customs. Thus, Japanese mascara has a finer consistency than the equivalent product sold in Europe.

Tapping into new expanding markets

“Developing a single product for the entire world is the exception”, says Dr. Nils Hoffmann, Manager R&D at Beiersdorf®, among others. The Hamburg native has lived 600 kilometers north of Mumbai for three years researching the personal care customs of Indians: “Countries such as India and China, but also the African continent, constitute expanding markets”, he says. Local economic development benefits more and more people who will now be able to afford care products.”

The factors that people in India, China or Africa consider essential for their daily care are analyzed with the help of tests and surveys – and they look over the shoulders of selected participants in specialized bathroom laboratories: from what distance is deodorant sprayed onto the skin? Does it take two fingers to apply the gel to the hair,

or is the entire hand involved? How much shampoo is used? These are the important details that may determine the success or failure of a product at the sales counter.

According to Nils Hoffmann, the richest source of detailed information is still the home visit. In this way, the chemist was able to observe that many people in India today continue to shower using a bucket of water. “People use a shovel full of water to

“*Once you are familiar with peoples’ customs, you will know which implicit expectations must be considered with respect to care products.*”

briefly wet their skin. They then lather themselves with soap and rinse, using another shovelful of water.” For these reasons, they require a completely different cleaning product than Europeans. Nils Hoffmann: “It must rinse off easily yet convey a pleasant sensation on the skin.” His biggest success already adorns the shelves of stores in India: a custom-developed deodorant. The background: Indians do not spray deodorant directly onto their skin,

but rather onto the shirt they are wearing. “In addition to offering a regional fragrance, it does not leave a stain on the clothes.”

Religion and climate are also involved

Whether it is Beiersdorf®, L’Oreal® or Unilever® – companies are willing to pay handsomely for research into the most diverse ethnic preferences. In 2017, Beiersdorf® invested 143 million euros in the research and development of new products alone. Across the globe, the company maintains seven R&D sites. L’Oreal® takes a similar approach by operating as many as 20 “Evaluation Centers” worldwide. “Once you are familiar with peoples’ customs, you will know which implicit expectations must be considered with respect to care products”, says Viola Sprick, corporate communications manager at L’Oreal®.

Even religion on occasion influences care preferences significantly: in Arabic countries, for example, people wear a heavy rose-scented fragrance to honor the sweat of the Prophet Mohammed.

Under certain climate conditions, for example, during water shortages in Africa, several people will wash their hair in the same tub. Their shampoo must be effective in water that has been previously used, and it must rinse easily, while at the same time being gentle, as darker skin is more susceptible to dryness.

The customs and preferences surrounding daily personal care in rapidly growing Asian metropolises have changed at a particularly rapid rate: currently, men value an elegant pallor, while women love shiny lips. Products that achieve the desired effects? Already on the market! Cultural diversity and fashion trends are the global drivers of a growing cosmetics industry. ■



Science for you
Beauty is a relative term – beauty products are customized to meet cultural needs

Cooking with Herbs

The path to health leads through the kitchen – with this motto, star chef Johanna Maier from Filzmoos in Austria delights her guests. Her secret: she cooks with medicinal herbs.

When Johanna Maier and her black lab set off on their daily walk across the mountainous region of the Salzburger Land, she always carries a container. Along the paths, she collects dandelions, nettles and wild garlic, which she will later incorporate into her sophisticated dishes. “Medicinal herbs and spices make our food more palatable as well as more aromatic”, says Maier. “They support our bodies; they comfort our souls and help us stay healthy.”

More than mere medicine

Johanna Maier has come by her knowledge on the effects of medicinal herbs through her formal studies to become a Practitioner of Traditional European Medicine. Even then, the chef never quite agreed with the notion that herbs exclusively serve a medical purpose. Chamomile, for example, is not only useful against stomach pain and as a balm for the soul! “I wondered why it couldn’t be served in delicious harmony with grapefruit juice and ginger to augment seafood and salads”, remembers Maier.

Ever since that time, something green has sparkled on the dishes created by the star chef. Her motto: “No dish without herbs.” The delicate plants are an integral part of the secret to her culinary art; their medicinal effect is considered a bonus. Since Maier shares her knowledge with others by conviction, she provides tips on the use of herbs and spices to hobby cooks in her cooking school. In her experience, home cooks often refrain from cooking with herbs as they feel overwhelmed by the multitude of choices.



Breckland thyme

This wild relative of thyme grows in mountainous regions above 1,200 meters. Breckland thyme has a slightly milder flavor than thyme. It goes well with Mediterranean cuisine

Don't be shy!

According to Maier, such reserve is unwarranted. “Once you become interested in herbs and spices, once you taste and feel the effect, you will never go back”, she enthuses. It is indeed a path of small steps that will lead to sensuous cooking and savoring.

On this quest, Maier takes hobby cooks by the hand. Knowledge surrounding the effects of herbs, which are based on bitter substances and essential oils, form the very basis. Bitter substances stimulate gastric juices and thus support digestion. Essential oils give plants their scent and lend spices their zesty aroma. They have spasmolytic,

anti-inflammatory and even antibacterial properties. According to Maier, the spicier a dish, the longer it will stay fresh. “It has been shown that foods that have been seasoned with cinnamon, cloves, oregano, thyme, chili or garlic are protected from harmful bacteria for a longer period of time”, emphasizes Maier.

Timing is everything

During the cooking process, each plant will exert its effect in its own unique way – the leaf, the blossom, the stem or the root. Accordingly, it is important for the herb to end up in the pot at exactly the right time. “Delicate plants release their aroma quickly and should therefore be added shortly before serving. Examples include basil or chives”, says Maier.

Other herbs, however, are only activated through grinding or heating – for example, lignified parts, seeds or bulbs such as coriander seeds, bay leaves or rosemary. A note of caution: prolonged heating will compromise the flavor. “Essential oils are volatile – they will soon end up in the kitchen air rather than in the pot, where they ▶



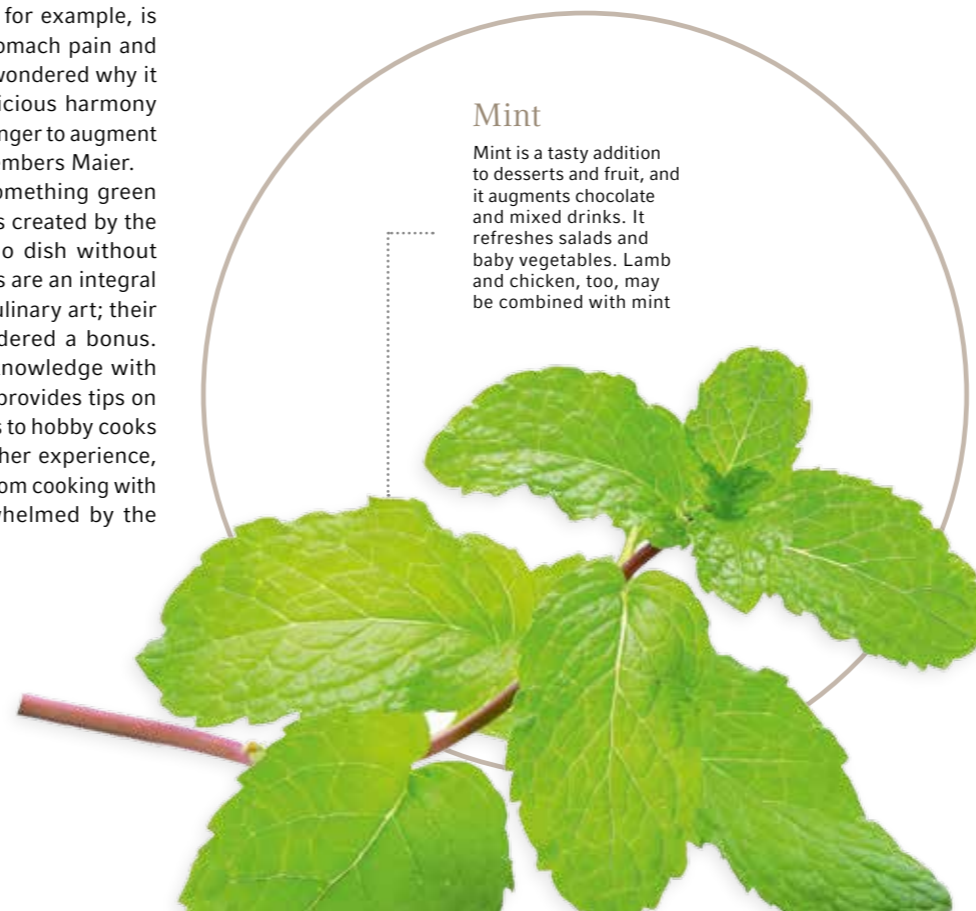
Sage

Sage is one of the most important treasures of local Alpine flora. It goes well with meat dishes, but also with pastries and fish as well as potatoes and pumpkin



Lemon balm

Lemon balm's essential oils smell like lemon. It is useful in all dishes that call for lemon or lemon peel, such as desserts, fruit salads or punches



Mint

Mint is a tasty addition to desserts and fruit, and it augments chocolate and mixed drinks. It refreshes salads and baby vegetables. Lamb and chicken, too, may be combined with mint



BLUEBERRY DATSCHI

Ingredients

- 1 ¾ cups fresh blueberries
- 1/2 cup wheat flour (type W 500 and type W 405)
- 4 Tbsp sugar
- A pinch of salt
- 1/5 cup milk
- 1/5 cup water
- 2 Tbsp butter
- Powdered sugar to sprinkle
- Cream, sweetened with vanilla



Preparation

1. In a bowl, carefully mix the blueberries with the flour, the sugar and the salt.
2. Heat the milk with the water in a saucepan, then carefully stir the liquid into the berry mixture using a wooden spoon. Some berries should remain whole while others may release juice and color.
3. Heat the butter in an oven-proof

pan and add the berry batter. Place the pan inside the oven, pre-heated to 170 °C (340 °F), and bake for approximately 10 minutes. Turn the Datschi over after half the baking time has elapsed. Remove the baked Datschi from the oven, sprinkle with powdered sugar and garnish with a dollop of vanilla whipped cream.

belong”, warns Maier. The combination, too, is crucial, as certain herbs and spices will enhance each other – such as ginger and garlic.

Wild herbs – robust and free

Wild herbs that she collects herself are Maier’s favorites. Whereas others will pass by chickweed, ground elder, ribwort, watercress or lady’s mantle, the chef picks them with enthusiasm. “Nothing compares to the healing power of plants that decide for themselves when and where to grow”, Maier shares passionately. They are skilled survivors – robust, with a zest for life, and free. “Adversity makes them stronger, and they transfer their enviable properties to the person who eats them”, she says. Those plants that do not grow wild are cultivated in the chef’s own herb garden.

Maier’s kitchen is by no means restricted to local ingredients; exotic spices such as cinnamon, cloves or turmeric, as well as ginger and vanilla, are welcome in her pots and pans. “The whole world is a scent, and for me, there is hardly anything more pleasant than discovering new aromas and combining them – not unlike composing a symphony”, Maier expresses with passion. In addition, the gourmet chef swears by the use of non-iodized rock salt as well as linseed oil, which lend her dishes a certain something.



Rosemary

This aromatic, spicy herb complements meat and tomato dishes as well as Mediterranean vegetable dishes. Large stems may double as aroma-infusing skewers



Don’t skimp on herbs! Start small, get to know the herbs slowly, and then expand your repertoire step by step.”

In order to make life easier for herself and for other hobby cooks, Maier has created around 20 different blends of spices. Her most important message sounds as calming as a mug of chamomile tea: “You don’t need rare varieties for everyday cooking. You just take what you like to eat”, advises Maier. Plenty of chives go a long way – further than using a large number of different herbs. Maier’s professional kitchen is never short of rosemary, chives, parsley, oregano and mint, as well as lemon thyme for fish dishes. In the summer, basil is added, and in the winter, sage.

Not too much, not too little
Star chef Johanna Maier masters the art of complementing her meals with the perfect ratio of herbs



Carrot Cake with Pineapple

Bring your own Recipe



INGREDIENTS

For the cake:

- 250 g flour
- 1 tsp: fine salt, baking soda
- 2 tsp: baking powder, cinnamon
- 400 g white sugar
- 225 ml vegetable oil
- 4 large eggs
- 60 g melted butter
- 2–3 heaping packed cups raw finely grated carrots
- 150 g finely crushed pineapple, drained
- 1/2 cup finely chopped pecans (optional)
- 1/2 cup finely chopped walnuts (optional)

For the frosting:

- 60 g unsalted butter, softened
- 150 g cream cheese, softened
- 1 1/2 teaspoons vanilla
- 300 g powdered sugar

What’s your favorite recipe?

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

magazine@ependorf.com

Cake: Preheat oven to 175 degrees C, Grease/oil a 30 x 20 cm baking dish. Sift or whisk flour, salt, baking powder, baking soda, and cinnamon in a bowl. Whisk sugar and eggs in large bowl. Add oil and melted butter to the egg mixture. Whisk until combined. Add carrots to wet mixture. Mix with a wooden spoon until combined. Add the flour mixture and the nuts. Mix gently until there are no dry spots left. Pour into greased baking dish. Bake 45 minutes. Let cool completely (at least 1–2 hours) before frosting.

Frosting: Mix butter and cream cheese until well combined and whipped. Add the powdered sugar a portion at a time. Beat the mixture until it becomes light and fluffy. Add the vanilla. Cover the entire top of the cake with frosting. Cover with plastic wrap and refrigerate for at least 2–4 hours. Best served when the cake is cold and the frosting is firmly set.

My Microbiome

Our bodies – inside and out – are practically teeming with microscopic life forms, which together make up our microbiome. How it is connected with different types of diseases is currently the subject of intense research.

Probiotic yogurt, special gut diets and health checks that include a stool test – the market for products for the gut flora has been booming for years. Science and industry alike are focusing on the human microbiome, i.e. the big picture of all organisms including bacteria, viruses, fungi and archaea in our bodies. It is a proven fact that the microorganisms in the human gut in fact impact our health – they help us with digestion, and they prevent the spread of pathogens inside our intestinal tracts. Would targeted treatment of bacteria within the gut therefore be capable of influencing the health of the patient?

Research into the intestinal flora

Dr. Ruth Ley of the Max Planck Institute for Developmental Biology at the University of Tübingen in Germany has dedicated her research to the microbiome. She wants to know more about the relationship between intestinal bacteria and the human body. For example, her team has discovered that microbes, i.e. microorganisms such as fungi or

bacteria in the human gut, are distinctly different from those found in the soil or in water, but that they are in fact related to those found in other mammals. “We are therefore talking about coevolution of mammals and microbes”, says Ley. The next goal will be to understand the role that microbes play in the evolution of humans. To this end, she is researching the human microbiome in relation to human genetics.

These studies have the potential to open doors to new therapeutic approaches for the treatment of chronic autoimmune diseases, which are on the rise in today’s society. “At the moment, we are strongly focusing on type 2 diabetes”, says Ley, “We are looking at certain lipids – the sphingolipids.” Sphingolipids are produced by bacteria as well as by the human body. Knowledge on how bacteria might influence the sphingolipid values inside the body may also be relevant for the role of insulin resistance as a precursor to diabetes. In addition, alteration of the microbiome may lead to promising treatment strategies for illnesses such as malnutrition or inflammation within the intestinal tract.

Even though research into this area of microbiology is still in its infancy, health-promoting products are already flooding the market. Probiotics and prebiotics are said to support the intestinal flora while strengthening the intestinal immune system. “However, we are still a long way from being able to address intestinal bacteria with such products in a meaningful way”, says Ley. In order to understand why current science doubts the effectiveness of products designed to influence the intestinal flora, insight into the composition of the microbiome is crucial.

Who am I, and if so, how many?

“If we want to be exact, we are for the most part more bacterium than human – depending on when we had our bowel movement”, says Dr. Daniel McDonald of the American Gut Project. Over the past four years, he and his team have been collecting stool samples from more than ten thousand people in the US, and they have ana-

INFOBOX



For the longest time it has been assumed that there are roughly ten times as many microorganisms inside the human body as there are body cells. These numbers were based on a 1972 study by the microbiologist Thomas Luckey. In 2016, a team of researchers led by Dr. Ron Sender, Dr. Shai Fuchs and Dr. Ron Milo of the Weizmann Institute of Science in Rehovot, Israel, performed their own calculations, according to which the average human is made up of roughly 30 trillion body cells – which comprise, on average, 43 percent of all cells. The rest is made up of our microbiome. For the scientists, the basis of these calculations was the “reference human” – weighing 70 kg at a height of 170 cm and between 20 and 30 years of age. In individual cases, double, or perhaps only half, that number of bacteria may colonize the body, but definitely not ten times the number.

lyzed them for their bacterial composition. McDonald: “The numbers vary considerably between different samples. Overall, we estimate a ratio of 1:1 between body cells and single-celled organisms within the body.”

“Average values such as these, however, make only limited sense where the microbiome is concerned”, explains McDonald. Many products of the health and food industries that are targeting the gut flora are based on average values, which is why their effectiveness remains doubtful to scientists. The connection between the microbiome and the metabolism has been confirmed – as shown by an experiment conducted on sterile mice, which, after treatment with human gut bacteria, either gained or lost weight, depending on the composition of the intestinal bacteria. Nevertheless, the question how these results may be transferred to man still remains open to McDonald: “Research on mice is distinctly different from research involving humans. Applying these results to humans is therefore extremely difficult.” ▶

Microbiome
Microorganisms such as bacteria, viruses & Co. have been proven to influence our health

66

We will one day be able to tap into the microbiome in order to influence health using specific microbes in the same way that we use vitamins.”

study conducted by the Weizmann Institute of Science, however, showed that many products that are available over the counter may in fact turn out to be harmful. Before the proper products can be recommended for a certain individual microbiome with confidence, additional studies on the connection between bacteria and health are needed. “We can already understand those connections – the underlying mechanisms, however, are difficult to define”, explains McDonald, while maintaining an optimistic stance. “We are so close to the breakthrough.”

New areas of research

If this breakthrough were to occur, and if the information gained was able to provide immediate information on the health of a person, medicine would be able to access a whole new array of possibilities. A single stool sample might be sufficient to provide targeted, individualized treatment of the intestinal flora, or combat diseases or parasites, using drugs or other products. Scientists like Daniel McDonald of the American Gut Project will continue to collect samples in order to provide the scientific community with as large a data set as possible. The more is known about the microbiome, the more areas of research are bound to open up. Ruth Ley of the Max Planck Institute, too, is optimistic about the future: “Once we understand the mechanism, once we identify the molecules that are exchanged between the microbiome and its host, we will one day be able to tap into the microbiome in order to influence health using specific microbes in the same way that we use vitamins.” ■

Experts discourage stool analysis

Despite these limitations, today, stool sample analysis is capable of providing valuable information on the DNA within the microbiome; for example, the combination of bacteria may determine whether a bacterial infection is present. Diagnoses of possible diseases or personalized recommendations for action, however, are not reliable, as the reference values on which such results are based simply represent averages. Each value that subsequently differs from the average of the reference human will then generate new variables which, in principle, could form the basis of a brand new study. Such studies are actually available on a small scale.

Freely available test kits will analyze the intestinal flora at one point in time or at successive time points, and these results will lead to the generation of advice on nutrition or recommendations for action, such as diets or the addition of nutritional supplements. The German Society for Gastroenterology, Digestive and Metabolic Diseases (DGVS) cautions that at the present time, the stool test lacks the required scientific basis. However, commerce involving prebiotic and probiotic supplements, in particular, has picked up speed in parallel with the rapid developments in the field of intestinal research. A recent

1 Smart Gut

Detox diet? Superfood? Colonic irrigation? Those who do not suffer from serious health problems can simply rely on their gut – without any extra treatment. The intestinal lining, including all surface cells, self-renews at regular intervals. A healthy diet, therefore, is all the gut really needs. Only if health issues arise will the gut signal that something is amiss. Even then, a trip to the doctor is the first course of action – before considering diets or irrigation.

The Center of the Body

The gut – in all likelihood the most underrated organ in the human body. Three tips for a healthy gut flora.

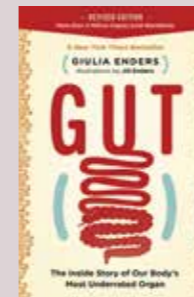
2 Good & Bad

The bowel harbors good bacteria and bad bacteria – a balanced ratio between the two is paramount for good gut health. This can be achieved through a balanced diet and, in particular, through the consumption of probiotic foods. Fresh fruit and vegetables, unsaturated fatty acids and fiber have a positive influence on the intestinal flora; animal products on the other hand – especially milk, cheese and red meat – are best consumed in moderation.

3 Stress is Fattening

In order to provide sufficient energy for the day, the stress hormone CRF (corticotropin releasing factor) creates small fat deposits every morning. In cases of too much stress (fear of exams, fear of flying), the hormone can trigger indigestion, vomiting and diarrhea. The gut is home to more than 100 million nerve cells – chronic stress may thus cause damage to the gut.

BOOK SUGGESTION



Is the gut really charming? In her debut book “Gut – the Inside Story of Our Body’s Most Underrated Organ”, Giulia Enders does not beat around the bush – she discusses farts, constipation and gut bacteria, and she explains why the gut is most likely our most underrated organ.

“Gut – the Inside Story of Our Body’s Most Underrated Organ”; Giulia Enders; 304 pages; \$17.95; GreyStone Books



Peril on the Plate

Allergy sufferers are longing for foods that they can enjoy without second thought. New molecular processes may be able to ease their lives. Even so, hypoallergenic products are still a long way away.

Death lurks on the supermarket shelf. Cow's milk, nuts, soy, wheat, fish or eggs: if such ingredients hide in, for example, ready-made meals, and an unsuspecting allergy sufferer is not careful, the worst outcome may be death. "Food allergies are not a trend or a lifestyle choice", emphasizes the managing director of the American organization FARE® (Food Allergy Research & Education®), Lisa Gable. "Families and adults living with this disease must be vigilant at all times, because in a matter of minutes, an allergic reaction can send someone to the emergency room with anaphylaxis."

The prevalence of food allergies and anaphylactic reactions is on the rise in Western industrialized nations. One of the causes, researchers suspect, includes the increased utilization of peanuts. Peanuts are found in granola bars, chocolate, sauces and ready-made meals – even in shampoos and body lotions. According to estimates, 5.4 million people suffer from a dangerous peanut allergy in the US and Europe alone.

Soy for starters

Thus far, allergy sufferers have only one option: they must avoid foods that contain their trigger. This is the reason that scientists are now working on the development of hypoallergenic foods. To this end, they are developing methods which will first identify those components which trigger the allergy, and subsequently neutralize them. "Until now, with the sole exception of baby food, no hypoallergenic foods are available on the market. Their production is highly complex", says Dr. Michael Szardenings of the Fraunhofer Institute for Cell Therapy and Immunology (IZI) in Leipzig, Germany. This has been partly due to the fact that the specific allergenicity of foods could not be established.

This is exactly what Szardenings and colleagues have now achieved for soy. They

developed a process that allows the direct detection and determination of those protein components (epitopes) which are recognized by the soy-allergy sufferer's antibodies, and which thus trigger the allergy, directly from the antibodies present in the serum. By applying this method, the researchers detected 374 allergy-relevant epitopes in soy. Using different heating methods, as well as treatment with plasma, pulsed UV-light, gamma-radiation and high pressure, chemical, enzymatic and fermenting processes, the researchers at the Fraunhofer Institute for Process Technology and Packaging (IVV) subsequently altered soy proteins in such a way that they have become less allergenic.

Genome editing with CRISPR/Cas9

Genome editing processes, too, have yielded promising results. This method allows the switching off of certain genes in plants so that ribosomes inside the cells will no longer produce the allergy-triggering proteins. The new CRISPR/Cas9 process is precise and easy to use. Using so-called "gene scissors", researchers can alter the genomes of plants by cutting, switching off or inserting new gene sequences.

Scientists at the Biotech start up Aranex at the University of Warwick, among others, are employing the gene scissors to knock out three peanut allergens. It is, however, considered unlikely that this will be sufficient to protect allergy sufferers. The peanut, after all, contains many additional allergy-triggering proteins. If all genes responsible were to be excised, the plant, most likely, would not be able to survive.

In addition, a reduction of the gluten-content of wheat by means of the gene scissors has recently been successfully achieved by researchers in Spain. Antibody assays showed that immune reactivity following the consumption of the modified bread and durum wheat was reduced by up to 85 percent as compared to the control group. Similar successes have previously been attained by researchers in the US and Spain using RNA interference (RNAi), a method which blocks genes in a targeted fashion.

People who suffer from a milder cross-sensitivity may find relief by simply choosing a different variety. As such, researchers at the Technical University in Munich, Germany, discovered that with tomatoes and strawberries, for example, the allergen content varies considerably across individual varieties – a phenomenon that has been known to occur also in apples. The results will serve as a basis for the selected breeding of hypoallergenic varieties.

Despite scientific progress, it still remains doubtful whether foods for extremely vulnerable allergy sufferers will ever reach supermarket shelves. "Marketing of hypoallergenic foods produced from genetically modified crops is currently not feasible as these varieties would have to be accurately differentiated from unmodified, fully allergenic varieties", states a German-American team of researchers in the journal "Molecular Allergy Diagnostics". This renders the production process risky and expensive – and therefore less attractive to companies. ■



INFOBOX

During the course of a true food allergy, the immune system reacts to the proteins in a specific food. Often, minute amounts of that food are sufficient to trigger symptoms. Cross-sensitivities against pollen-associated foods, however, are an entirely different entity. For example, a person who is allergic to airborne birch or hazelnut pollen will often not tolerate certain fruits such as apples, cherries or kiwis. In these cases, the immune system confuses the apple with birch pollen. All other reactions to food constitute food intolerances, i.e. non-allergic hypersensitivities. While these hypersensitivities are caused by mechanisms distinct from the immune system, their symptoms frequently resemble those of "true" allergies.

Keeper of Rare Species

The Panda Base in Chengdu, China, is dedicated to the protection and breeding of the gentle giants and other rare species, as well as to research – a commitment with global impact.



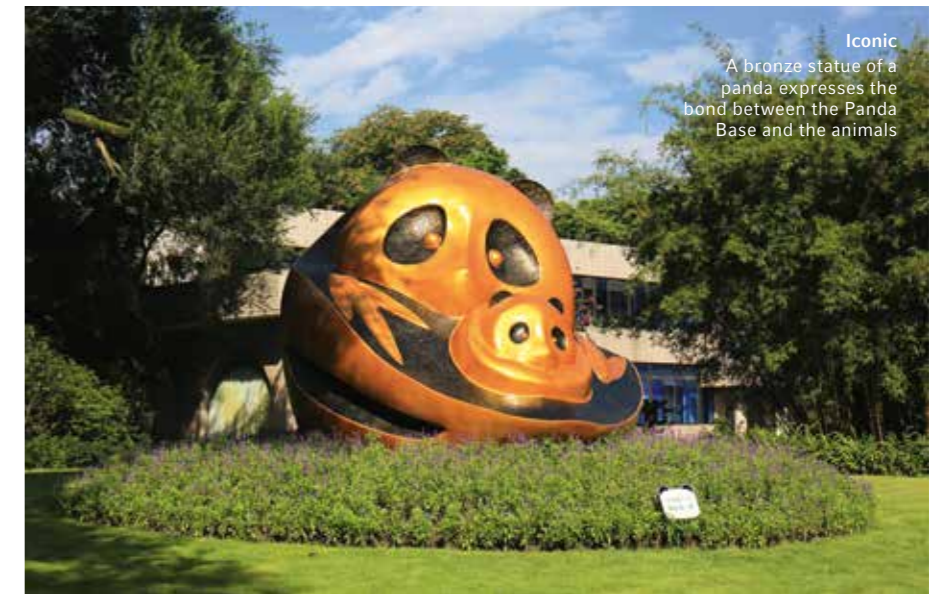
Cute, popular and endangered
The loss of its habitat impacts the Giant Panda

The Chengdu Research Base of Giant Panda Breeding (also known as “Panda Base”), situated in a northern suburb of Chengdu City, in Sichuan Province in China, specializes in the research, protection, breeding and management of rare animals including pandas. Importantly, the Panda Base is an expert facility which prepares the pandas that were bred in captivity for their eventual release into the wild. The facility, which covers an area of 102 hectares, was built in 1987, with major funding from the Chengdu municipal government; a phase III expansion of the facility was completed in 2009. Besides serving as a public education center, the Panda Base is engaged in such diverse initiatives as ex-situ protection, scientific research and breeding, international cooperation and exchange, field research, public education, ecological tourism and cultural brand creation, as well as other roles for Chinese pandas.

It all began when six sick and starving pandas were successfully saved in the 1980s. Since that time, the Panda Base has bred a total of 166 embryos and 255 panda babies, of which 184 are thriving to this day. Today, the Panda Base holds the world’s largest artificial panda breeding protection program, while at the same time it is home to 103 lesser pandas and other rare animals such as black swans and peacocks.

Advocacy and outreach

As one of the major research institutions of the “Endangered Wildlife ex-situ Conservation Project”, implemented by the Chinese government, the Panda Base continues to promote the healthy development of captive pandas, and it supports wild in-situ conservation through technological means. The institution houses the main National Laboratory Breeding Base, jointly built by the Ministry of Science and



Iconic
A bronze statue of a panda expresses the bond between the Panda Base and the animals

Technology and Sichuan Province, and the main Sichuan Provincial Laboratory – the “Sichuan Provincial Endangered Wildlife Protection Biology Key Laboratory” and the “National Post-Doctoral Scientific Research Workstation”. The successes of the institution include more than 70 scientific research findings, scientific and technological achievements. The Panda Base has published more than 400 papers in domestic as well as international journals.

Through its combined animal welfare and conservation efforts, the Panda Base has been able to make outstanding contributions to the promotion and continuous development of global captive panda protection and research efforts. The Panda Base is internationally recognized as the Panda ex-situ Conservation Demonstration Unit with the strongest scientific and technological capabilities and achievements, as well as for its outstanding contributions to captive panda protection at home and abroad. In June 2017, “Mengmeng” and “Jiaoqing”, pandas born in the Chengdu Research Base of Giant Panda Breeding, arrived at the Berlin Zoo in Germany. They play an important role in further promoting Chinese-German friendship.

Interview

The special focus of the Panda Base: its scientific research.

Mr. Zhang, I see that your background is in molecular biology.

Zhang Wenping: That’s right. I have been involved in molecular biology since my postgraduate studies.

Could you briefly introduce the role that molecular technologies play in panda protection?

Zhang Wenping: At the very beginning, in 2003, we employed molecular biology technologies to study the genetic diversity of pandas, and we adopted microsatellite markers to perform paternity tests. My doctoral project concerned the genetic diversity of South China tigers. Beginning in 2008, we started using high-throughput sequencing methods to analyze the intestinal flora of pandas. Further improvements in technology will definitely help enhance our research.

We see that you mentioned in your latest research that pandas eat bamboo to maintain the energy needs for their daily ▶

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Wild pandas mainly eat bamboo and bamboo shoots with a high content of hemicellulose and starch. For this reason, their food source must be protected, and bamboo should not be cut excessively.”

which the clones were derived. We then gradually developed the 454 sequencing method. It generates longer readouts, up to 200 bp through joining, and we now rely on the MiSeq second-generation sequencing method.

Are your results based on gel or capillary electrophoresis?

Zhang Wenping: We used the capillary electrophoresis method for identification. The abundance of a target gene, as well as gene polymorphisms, and rough point mutations may be visualized in this way. In contrast, qPCR will only detect the abundance of a gene; it is not able to elucidate the number of different variable fragments of a gene. When analyzing the intestinal content of pandas, this method helps us determine whether animals have roundworms and how many roundworms there are in their bellies.

Your analysis is mainly based on excrement. Do you have other sample sources?

Zhang Wenping: Because pandas are very special, we mainly use non-invasive sample collection methods, such as excrement and urine. They are preferable to blood sampling even though processing is more difficult. We monitor our pandas, and when we find excrement, we collect it and send it to the laboratory for processing as soon as possible. After washing with PBS, it is snap-frozen in liquid nitrogen and transferred to -80° for long-time storage.

Your processing method is somewhat similar to sample pretreatment for metabolome analysis.

Zhang Wenping: Yes. We plan to get involved with metabolome analysis next, and our project will concern multi-group conjoint analysis to find related target spot objects and confirm their causal relationship. In addition, we will conduct more in-depth research into the metagenome of the intestinal tract of pandas. For example, we will confirm which floras are beneficial or harmful to the health of pandas, and we aim to provide a theoretical basis for more scientific and reasonable feeding practices. ■

activity, and that the energy is in fact derived not from the cellulose, but from other nutrients found within bamboo. Could you briefly introduce the work that is conducted in this field of research?

Zhang Wenping: When I started working on the subject, I also felt the cellulose and the lignin of bamboo should be the main nutrients that provide energy to pandas. However, we soon found that from birth to subadult, the pandas' cellulosic flora does not increase gradually. We now believe that pandas have a very limited ability to digest and degrade cellulose. In contrast, during the period from birth to subadult, their flora capable of digesting hemicelluloses and starch increases, and the expression of a gene family related to these floras also gradually increases. We concluded that pandas obtain their energy through digesting the hemicellulose and starch present in bamboo, whereas cellulose may simply play a subsidiary role.

Could you elaborate on the importance of this research on the breeding and protec-

tion of pandas? We know that the pandas' survival had been impacted previously by changes affecting their food source.

Zhang Wenping: We were able to define the nutrients most important to pandas: wild pandas mainly eat bamboo and bamboo shoots with a high content of hemicellulose and starch. For this reason, their food source must be protected, and bamboo should not be cut excessively. In the 1980s, as bamboo bloomed, a shortage in the pandas' food ensued, and as a result, their survival was greatly affected.

You mentioned that metagenome analysis is used to research panda excrement. Could you briefly describe the application of the metagenome in this research?

Zhang Wenping: The metagenome contains all bacteria, fungi, viruses and other microorganisms. In the beginning, we extracted total DNA from the excrement or the bacterial suspension. The DNA included the DNA of various microorganisms, and we used the method of 16s database building to help identify the exact bacteria from



In need of protection
The offspring enjoy an ideal environment in which to thrive



Visitor magnet
The Panda Base as a popular destination for interested visitors



Engaged protector of animal welfare
The director of the Chengdu Panda Base, Prof. Dr. Zhang Wenping



To the Beat of the Metropolis

Tokyo is a place between two worlds. Ultra-modern and traditional, intrusive and shrill and – sometimes – really, really quiet. Visiting a city of fascinating contrast.

On the runway of Haneda Airport, an air traffic controller in a neon-yellow vest is bowing before the plane that has just landed: my first glimpse of Tokyo and Japanese custom. At the airport train station I wait for the Tokyo monorail. Beside me, a man is cleaning the concrete floor with a vacuum cleaner, while another, carrying a sponge in one hand, travels up and down the escalator to clean the space between the handrail and the adjacent wall. Pleasant melodies announce the arrival of the punctual train that will take me in the direction of Akihabara in only 20 minutes.

This neighborhood is known for its large number of electronics shops and it is considered the center of Japanese otaku culture. This is where otakus, the passionate fans of animes, mangas and video games will find the right equipment for their hobbies in one of the many shops. Even a leisurely walk through the streets of Akihabara proves taxing to the senses. I walk a bit too close to one of the many Pachinko halls. An automatic door opens and I am at once enveloped in a shrill cacophony of Japanese plastic pop music and extremely loud casino noises. Amidst blinding, twitching strobe light, young people smoke and operate brightly colored slot machines. Around the corner, in one of the numerous maid cafés, young women dressed as maids invite passers-by to tea and pastries.

Creative kawaii culture

What Akihabara is to the otakus of manga and anime, this is what Harajuku means to young Japanese fashion enthusiasts. As early as the 1970s, a unique fashion style emerged along the Takeshita Dori that is oriented towards the esthetic principle of kawaii (English: cute) and which displays pronounced cuteness. The sauntering young women in their pink lace blouses and sky-blue tulle skirts, who wear sparkling tiaras or furry bunny ears on their heads, appear as if straight out of a manga. The culinary selection in Harajuku is also “kawaii”. At the “Angels Heart” café, ▶

A well-known face
Shrill, colorful,
loud – that is Tokyo.
But the metropolis
has another side to it.

which has been serving sweet crêpe-creations since 1977, I select a strawberry cheesecake crêpe with plenty of whipped cream, fresh strawberries – and a piece of cheesecake in the center. For dessert, I buy pastel-colored cotton candy, directly across the street, at the Totti Candy Factory. Holding the massive colorful cotton candy, I blend right in.

An ocean of light

Each Tokyo neighborhood is a microcosm unto itself. More than nine million people live in the Japanese capital; an additional 37 million people reside in the metropolitan region Tokyo-Yokohama, the world's largest and most densely populated metropolitan area. Those who wish to get a feel for the dimensions of this gigantic city must travel to a higher elevation – for example, the 45th floor of the Tokyo Metropolitan Government Building in the neighborhood of Shinjuku, also known as "Tokyo's City Hall". The observation platform is open between 9:30 am and 11 pm, and entry is free. In only 55 seconds, an elevator will

transport visitors to an elevation of 202 meters. I arrive shortly before 11 pm, and the view through the panoramic windows is simply stunning.

Tokyo sparkles; it flashes and it teems. Those who have the privilege of viewing its ocean of light from above will sense its special energy. Everything is illuminated, everything is moving. The beat of Tokyo at its most intense – simply experience the famous "all go" intersection between Shibuya Station and the shopping street Center-gai, only seven minutes from Shinjuku via the Yamanote Line. At peak times, 15,000 pedestrians cross the street during a single light cycle – up to one million per day.

The old soul of Tokyo

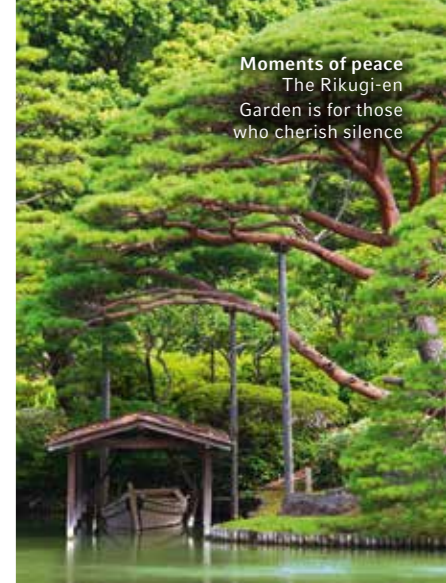
This side of Tokyo gives the impression of being shrill, ultra-modern and a little out of breath. People on trains are tired, some even fall asleep standing up. Those who take a closer look will discover, beyond the flashing neon signs and beneath the tightly woven carpet of commercial jingles, the quiet side of Tokyo.

It is exemplified in one of the many izakayas, the mostly small and very cozy pubs where, besides beer and sake, traditional foods are served. Such is the case in the Sakai Shokai, located a mere six minutes' walk from Shibuya Station, in the 3-chime-6-18. Sitting at its long wooden bar, I am in the perfect spot to watch the owner prepare fresh sashimi.

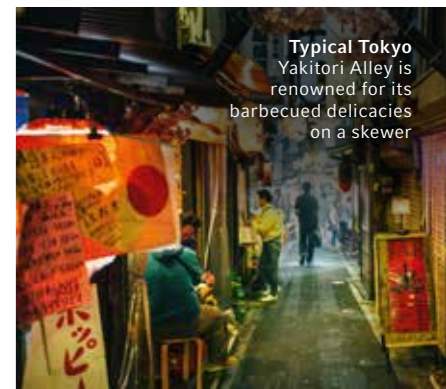
I catch a glimpse of the old soul of Tokyo while I take a walk through the narrow alleys of the Yanaka Quarter which had escaped WWII undamaged. Many old wooden houses, more than one hundred temples and the cemetery steeped in history are reminiscent of the Edo period – similar to the Rikugi-en Park in the Tokyo district of Bunkyo. 20 minutes away by train, Rikugi-en Park is considered one of the most notable gardens of that era, where time seems to stand still. In the midst of this park, you will find the tea house Fukiage Chaya. I order a bowl of matcha, glance across the small lake, and in the distance I see the skyscrapers of lively Tokyo. This is the other side of the city. Quiet and slow. ■



Shibuya 109
An absolute must-see: the spectacle at Tokyo's most famous intersection



Moments of peace
The Rikugi-en Garden is for those who cherish silence



Typical Tokyo
Yakitori Alley is renowned for its barbecued delicacies on a skewer

LET'S GO!

Food, panoramic views and art: tips for a complete visit to Tokyo

BIOPHARMA EXPO 2019

The BioPharma Expo is Japan's largest exhibition for biopharmaceutical technologies, and it encompasses the areas of Research & Development technologies, manufacturing technologies, and services. It takes place every year in Tokyo as part of the INTERPHEX Week Japan – Asia's leading event for the pharmaceutical industry with roughly 1,350 exhibitors and 300 speakers, as well as visitors from Japan and all over Asia. Between July 3rd and 5th, 2019, Eppendorf is looking forward to welcoming you with a broad portfolio and plenty of expertise on current and innovative topics on all things laboratory.

<https://bit.ly/2Co814n>



1

Tokyo is an exciting and creative city when it comes to the culinary arts. Those who wish to take tea with the Mad Hatter like Alice in Wonderland are invited to first navigate the maze of the Queen of Hearts in Shinjuku. Particularly colorful foods are on the menu in **Alice's Fantasy Restaurant**. Those who feel so inclined may wear rabbit ears or cat ears while dining. Fans of the Ghibli anime classic "My Neighbor Totoro" should make their way to **Shirohige's Cream Puff Factory** in the Tokyo district of Setagaya. This is where cream puffs in the shape of the cute forest ghost are served, filled with peach, chestnut or caramel-banana cream. The café is small and the cream puffs are popular. It is best to make reservations in advance.

alice-restaurant.com

shiro-hige.com



2

Interactive and limitless – this is how art is best experienced in the **Digital Art Museum** in the Tokyo neighborhood of Odaiba. The art collective teamLab set out to create barrier-free art and new sensory experiences. More than 500 computers and projectors control the installations. In the "Flower Forest", flowers in all shapes and colors are on exhibit; in another room, a massive virtual waterfall is falling from the ceiling. Some of the colorful installations can be controlled by the visitors via app. It is best to order tickets in advance online.

borderless.teamlab.art

For a break from fast-paced Tokyo, and for a spectacular view of the city, a day trip to the 599-meter-high local mountain **Takaosan** is the perfect destination. If the weather is good, one may be able to see Mount Fuji. Roughly 50 minutes from Shinjuku by train on the Keio Line, one will reach

Takaosanguchi Station. Several hiking paths that are also suitable for beginners lead through a forest to the viewing platform. Once you have arrived at the destination, many small restaurants offer refreshments. Those who prefer not to hike can easily reach Takaosan via cable car.

japan-guide.com/e/e3029.html



3

Keepers of Microbes

The scientists at the Leibniz Institute DSMZ in Braunschweig conduct their research in the realm of the invisible. Their findings serve the protection of humankind, the earth and space.

We cannot see them with our naked eye, yet they define life on earth – bacteria, phages, viruses and fungi. Microorganisms have existed on this planet for roughly four billion years: they make up 70 percent of the total biomass on earth. For thousands of years they were invisible to the human eye. Only when scholars began to use the first microscopes, towards the end of the 17th century, did microbiology emerge as a research field. More centuries passed before researchers discovered the connection between health, disease and microbes.

These days, the importance of microbes is uncontested. At the DSMZ – Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (German Collection of Microorganisms and Cell Cultures) – one of the largest bio-resource centers worldwide, which is celebrating its 50th anniversary this year, microbes are archived as well as studied. More than 50,000 cultures, among them thousands of different strains of bacteria and

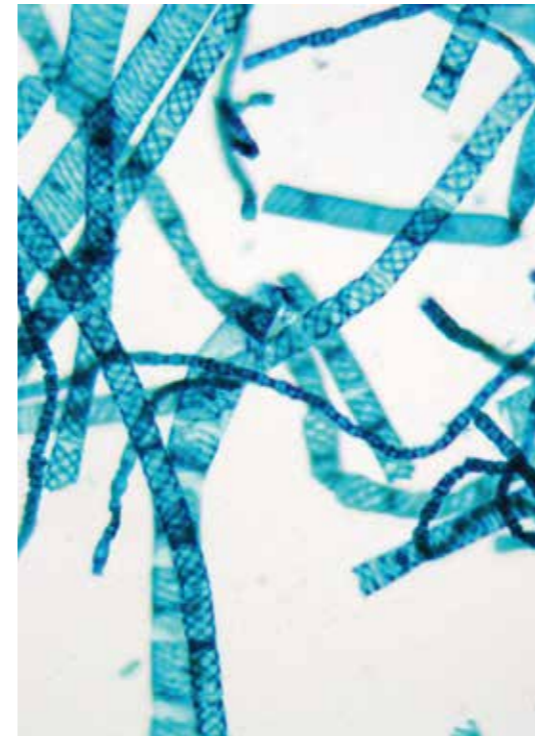
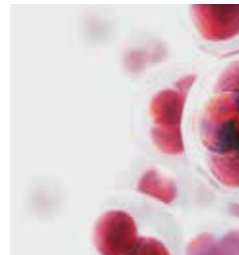
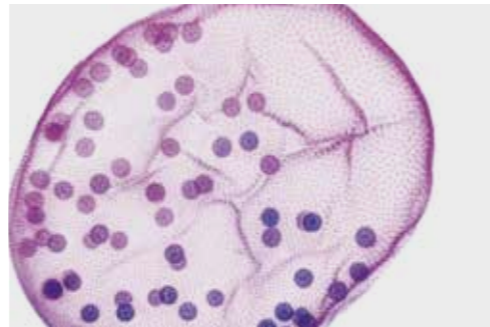
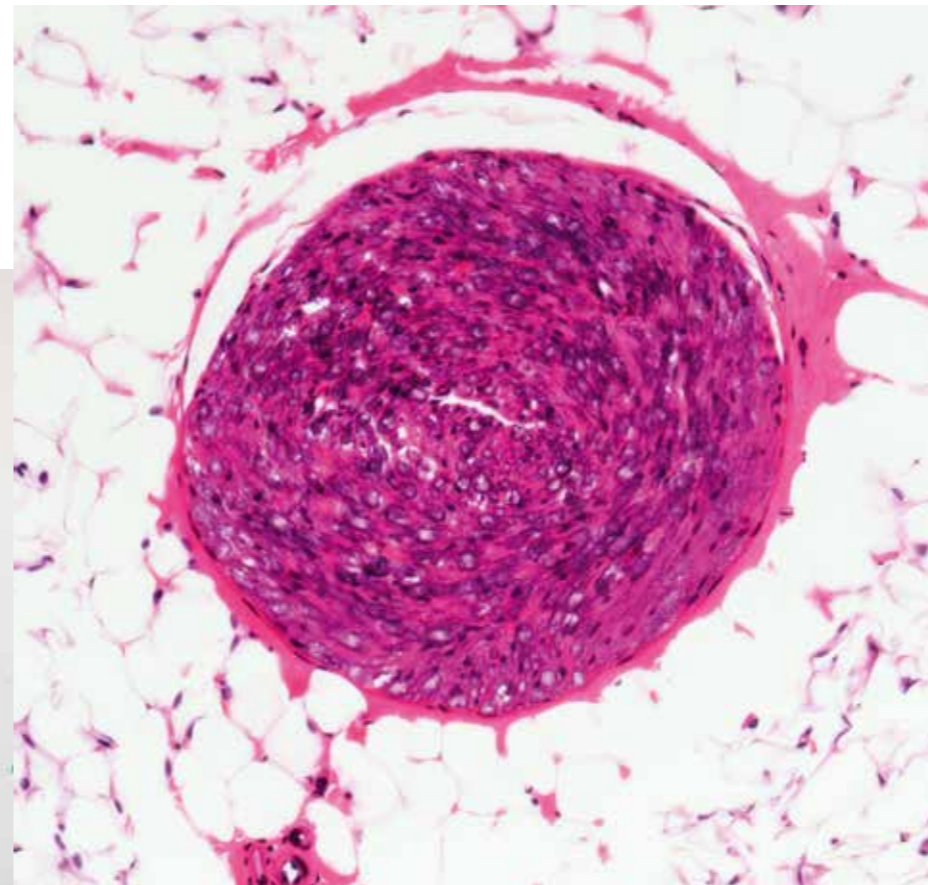
fungi, cell lines of human, animal and plant origin, plus plant-viruses and antisera as well as genetic material from bacteria, are stored in vials, frozen tanks and culture vessels at the DSMZ.

Phages, instead of antibiotics, can save lives

They reveal how microbial diversity has arisen throughout the course of evolution, and how microorganisms are involved in the causes, and in the control of, disease. This comprises a particularly vital field of study, as classic medicine is increasingly reaching its limitations. Antibiotics, the presumed wonder drugs of the 20th century, capitulate before multidrug-resistant pathogens. According to an analysis published by the European Antimicrobial Resistance Surveillance Network (EARS-Net), more than 30,000 people per year die from these killer pathogens in the EU alone.

“We were spoiled by antibiotics”, summarizes Dr. Christine Rohde, Head of the Research Group for Clinical Phages and Reg-

ulations in the Department of Bio-Economics and Health at the Leibniz Institute DSMZ in Braunschweig. “But now we have entered an era where desperation is spreading in the face of resistance. We have to move quickly and find alternatives. Luckily, such alternatives do exist. Bacteriophages – tiny viruses – attack harmful bacteria, colonize them, use them for their own reproduction and finally lyse and destroy them. Research-



For global research

The German Collection of Microorganisms and Cell Cultures (DSMZ) houses more than 50,000 cultures

ers and doctors already took advantage of these entities during the last century.

Shortly after WWI, more than 1,000 staff worked at the Georgi Eliava Institute for Bacteriophages in Tiflis, the capital city of Georgia. They produced large amounts of phages in massive fermenters. “These were used by the Russian Army in WWII for prophylactic as well as curative purposes against infection”, says Rohde. “In Tiflis, an immeasurable wealth of experience is archived, but unfortunately, all the early studies were published in Russian”, regrets Rohde. “We are only at the beginning of our own research, and we need a lot of money and our own published clinical studies which comply with the norms of “Good Scientific Practice”

in order to generate results that will be ready for application.” This is predicted to take a few years. At this time, phage therapy is not approved for humans in Germany. But Rohde had already helped extend the life of Ropen – the Indian one-horned rhinoceros at the Nuremberg Zoo who had a serious infection and where antibiotics had not been effective. Only the phages obtained from DSMZ were able to extend his life and prevented him from being put to sleep at the time. Ropen later died in 2017 at the old age of 29.

Exchange with the entire world and protection of space

Phages are a powerful example of the importance of exchange among researchers. It is therefore not a surprise that DSMZ, with its vast collection of microbes, is a sought-after contact for scientists, diagnostic laboratories and industrial firms worldwide; they can simply order samples online from the DSMZ shop. Roughly 40,000 packages carrying valuable sample material leave the laboratories in Braunschweig annually and arrive in the hands of approximately 10,000 customers in 90 countries. In return, many scientists from around the world donate their own biological materials to their colleagues in Braunschweig and their open collection, complete with annotated information.

And that is not all. The scope of the microbe-specialist is continuing to expand. Latest results have uncovered the fact that certain microorganisms can survive extreme conditions such as those found in clean rooms or in space. In collaboration with the European Space Agency ESA, the DSMZ is conducting research on these resilient organisms. This research is conducted in order to prevent the accidental distribution of such microbes in space. A branch of science that would excite even Mr. Spock of Star Trek: “Fascinating.” ■

Lab Lifestyle



Science meets Poetry

If we cannot find the right words, we often end up talking at cross-purposes. This is true in particular in the field of biomedical research, where the conversation between clinics and the pharmaceutical industry moves between entirely different linguistic frames of reference. Neither our academic career path nor public perception particularly value science communication – which is why the ability to describe our endeavors in a comprehensible manner is withering on the vine.

On a personal level, playing with the words of science can be quite rewarding. The vagueness of terminology opens the door to the freedom of creativity. Creative management of words is poetry. Few expect synergy between rhyming verse and scientific fact, and as a result, audiences are surprised when I recite my poetry of science.

For the past few years, I have been attempting to describe my research in such a way that it can be understood by all. I create metaphors to portray my work to my fellow humans. The art of communication in science has guided me from prose to

verse, which I publish from time to time on Instagram, alongside photographs of my scientific work. Other works are presented on the stage in front of hundreds, and sometimes thousands, of people at the “Science Slams” that are held regularly throughout Germany. The goal is to present one’s research in a way that is both clear and entertaining to a general audience. The lyrics form an essential part of my performance, as they are presented in the form of a rap. It certainly contains an element of surprise – the audience is not expecting a presentation of this nature.

YouTube® videos prove that, following the initial silence of disbelief, the lyrics are then celebrated frenetically; an impression that has been confirmed during a poetry reading of science-inspired works that I had organized recently.

The reactions and the feedback received from the guests at such events prove that science communication can have an inspirational effect and that this is indeed appreciated. Science meets poetry? Bullseye!

Dr. Lorenz Adlung was born in 1989 in the picturesque city of Erfurt in Thuringia/Germany. He is widely known as a science enthusiast, who now conducts his research on systems biology and personalized medicine at the Weizmann Institute of Science in Israel. His work can be found under his name on various social media platforms, as well as on his blog:

<https://lorenzadlung.wordpress.com>



Très chic!

DNA-earrings, petri dish pendants – even a necklace featuring Eppendorf pipettes: the jewelry by “somersault18:24” makes a researcher’s heart beat faster. Inspired by science, Idoya and Luk create beautiful things from silver. “We add new designs almost every week”, say the science-enthusiasts who invest \$5 of the profit in educational resources for scientists, students and teachers.

www.sciencejewelry1824.com

Deceptively real

Take a slice of bread; slather it with peanut butter and wait a couple of weeks, and soon mold will sprout. A more esthetic and appetizing version is created by Elin Thomas: the fiber artist builds her science experiments using a felted wool base and then carefully crafts individual growths using crochet and embroidery techniques. Each petri dish is a small masterpiece in itself!

elinthomas.bigcartel.com



Win Sunglasses!

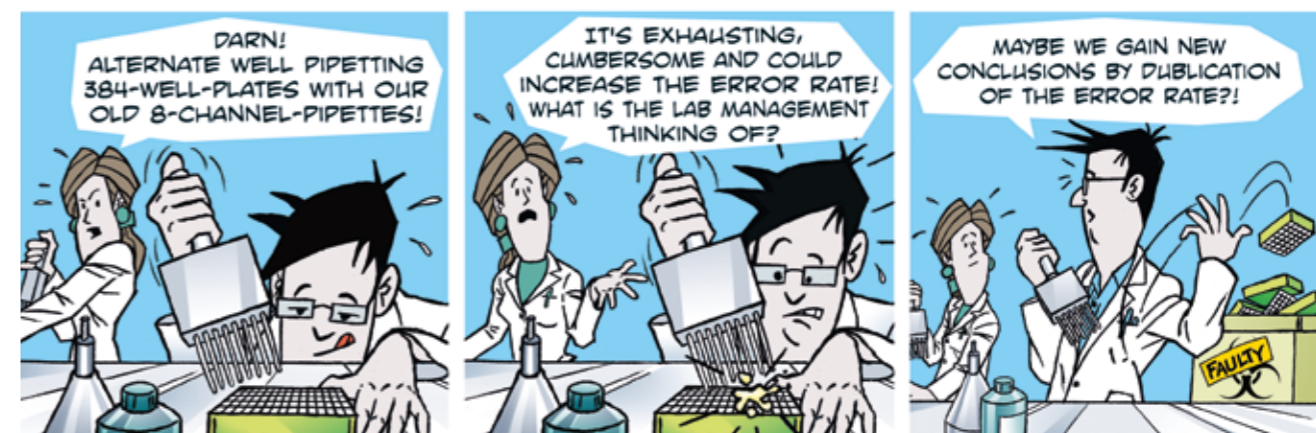
With the warm season just around the corner, are you looking forward to spending sunny hours outside? Win the new sky blue Eppendorf sunglasses or, better yet, equip your entire team! Simply answer the following question:

The new mechanical and electronic multi-channel pipettes by Eppendorf are available with how many channels? Tip: take a peek at page 44!

Send us an e-mail to magazine@epppendorf.com or register as a subscriber and leave us a message with the correct answer. Please find the terms and conditions on our website.

www.eppendorf.com/otb

At the Bench



www.eppendorf.com/pipetting

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Smart laboratory equipment with intuitive user experience: lay the foundation for your smart workplace with VisioNize

If you are familiar with Eppendorf instruments, you know that we put all our efforts and extensive experience into every device to support you and your lab with every step you take.

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Familiar with VisioNize? Well, Eppendorf is here to share it with you. With VisioNize-onboard, your devices stay in line with future-proof development. We strive to enable you to use state-of-the-art technology and make your lab as convenient as possible. Our freezers are not only advanced, we transform them into smart storage. We not only evolve cell cultivation, we transform cell culture with the smartest technology and services to keep you on track, 24/7.

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Flexible and smart
VisioNize® – the
intelligent way
to manage one's
laboratory

same intuitive framework, once you know one device interface, you know them all – across product lines and platforms, intuitive operation and distinct usability is ensured. Furthermore, you receive easy access to trend and tracking data with multiple graphs directly on each device.

Explore your possibilities

We at Eppendorf strive to improve the lives of our customers. Our job does not end with simply offering a smart device to our customer; it continues to grow as we improve the processes and applications in your lab.

We know that Life Science revolves around the sample. As simple as that may sound, we never underestimate the effort you spent on every single sample and your need to keep them as secure as possible. That is why we go one step further and combine the longevity and quality of our existing products with VisioNize, our digital companion.

In 2019, you not only get smart devices with VisioNize-onboard, we go further into the future and provide you a better way to



Smart Storage
Your samples will
be on cloud nine.

keep your high value samples safe. We are taking safe sample storage beyond the freezer door and integrating it into your larger laboratory workflow. Using our smart digital companion VisioNize, you can confidently guide your lab toward a smarter future.

More information at:

eppendorf.com/visionize

Cool Turns Green

Besides direct CO₂ emissions, the hydrofluorocarbons (HFCs) used in cooling systems like ULT freezers increase global warming. As a result, there is a move from hydrofluorocarbons to green gases.



Sustainability discussions mainly focus on energy consumption. Ultra-low temperature (ULT) freezers consume lots of energy to maintain extremely low temperatures 24/7. Even by using new, energy efficient ULT freezers the power consumption is still high. Due to sample safety, a dynamic compressor system and fast recovery rates are given. Energy saving rates are limited by these requirements.

Besides energy consumption, the insulation foam as well as the type of cooling liquid has increasingly come into focus. When the ozone depleting CFC*-based cooling liquids (*chlorofluorocarbons) were phased out some years ago (based on the Montreal Protocol), they were replaced by alternative compounds such as hydrofluorocarbons (HFCs). Despite being better for the environment, HFCs like R508b and R404a still have a high Global Warming Potential (GWP).

Hydrocarbons

In 2014, the European Union announced a ban of all non-hydrocarbon-liquids by 2020 (EU_517/2014). The EU ban includes all new cooling devices except instruments for temperatures below -50 °C. Based on this exception, ULT freezers of -86 °C may

continue to run with HFCs. Still, green units are expedient for new ULT freezers to counteract global warming.

Green or natural gases are aliases for hydrocarbons. The two major representatives are propane (R290) and ethane (R170). According to IEC 60335-2-89, no additional safety instructions for using green gases in ULT freezers are necessary.

With this goal in mind, Eppendorf will redesign all ULT freezers to green freezers within the next few years.

Looking back to 2008

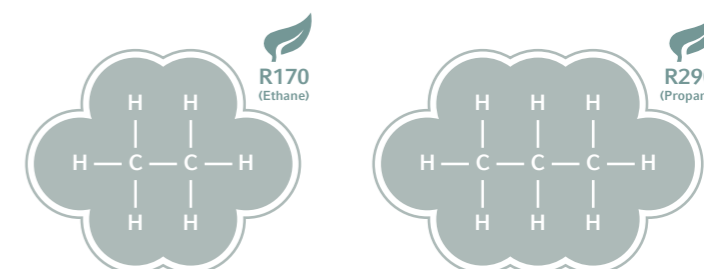
The (Eppendorf) New Brunswick™ Premium U570-G was one of the very first ULT freezers in the market that used green cooling liquids. After ten years of experience

in R&D, production, logistics, and service in the field, we are happy to see the concept globally confirmed. Nowadays, the majority of ULT freezers in Europe are sold as green units. Asia and America are following suit. A growing number of users take green ULTs for granted.

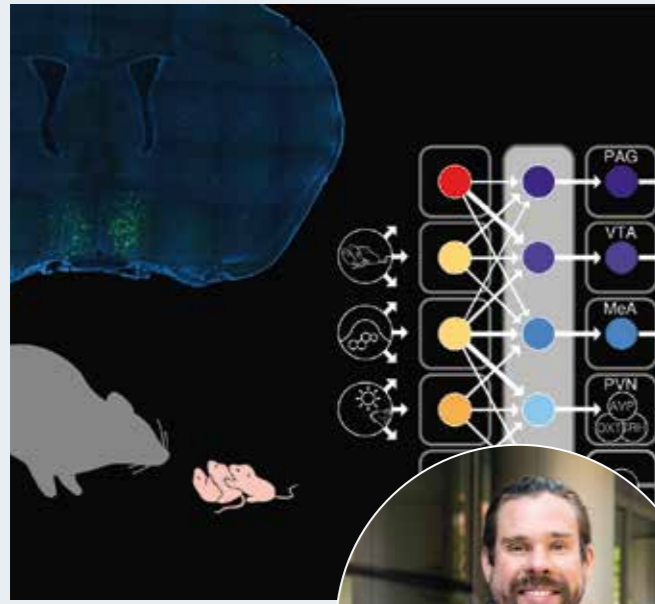
Recent steps with respect to switching to future-proof, green cooling liquids have been accomplished in our flagship series of CryoCube® F740 freezers (F740h, F740hi, and F740hiw (water-cooled)). But this is only a further step in a long, green Eppendorf story.

For additional information, please visit

eppendorf.com/freezers



Green cooling liquids = HC gases = Natural gases = Future-Proof



Eppendorf & Science Prize: Johannes Kohl

Parental behavior is essential for the survival and well-being of mammalian offspring, but the underlying neural mechanisms are incompletely understood. The German scientist Johannes Kohl, PhD from Harvard University® and winner of the 2018 Eppendorf & Science Prize for Neurobiology, showed under the mentorship of Catherine Dulac that a genetically defined population of neurons deep in the brain coordinates the motor, motivational, hormonal and social aspects of parenting. These neurons form a hub in a brainwide circuit

and then they form pools – defined by their projections – each of which controls discrete aspects of parenting. This work might provide a blueprint for how other types of social behaviors are controlled by the brain.

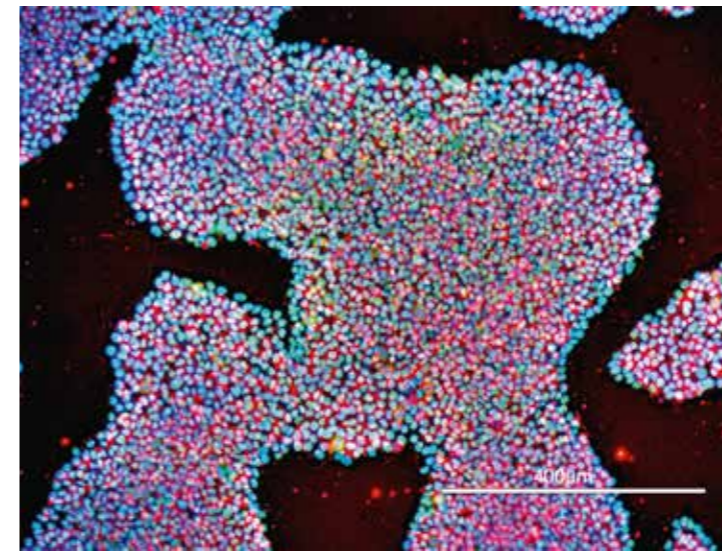
In 2019, he will start his own group at The Francis Crick Institute in London, investigating how physiological states affect information processing in neural circuits. Johannes Kohl hopes to eventually open new avenues for treatment of common mental illnesses.

www.kohl-lab.org

Johannes Kohl
From postdoc at Harvard University to principal investigator – in 2019, Johannes Kohl will start his own lab at the Francis Crick Institute in London

What Slows Down Stem Cell Research?

Stem cell research harbors great potential, but the cultivation of these sensitive cells proves to be anything but trivial.



While it is essential to be able to maintain the properties of self-renewal and continuous proliferation in cell culture for a sufficient period of time, it is equally crucial that differentiation be initiated in a targeted fashion and that it can be steered in the desired direction. In reality, however, spontaneous differentiation and insufficient reproducibility are among the most frequent problems. Accordingly, the demand for regulated, consistent growth conditions is high – in particular with respect to the culture

medium, the surface coating of the culture vessels that most stem cells require, as well as the incubation atmosphere.

Approaches to solutions

In many cases today, synthetic culture media are used which preclude the natural variability inherent in the composition of biological media. If synthetic media are combined with synthetic surface coating, completely serum-free, highly reproducible culture conditions can be created. A stable atmosphere inside the CO₂ incubator is another important factor, as even minute variations may potentially compromise cell viability or even trigger spontaneous differentiation. In this regard, daily handling of the culture vessels outside the incubator, for the purpose of visual checks, constitutes an extraordinary challenge; it is therefore paramount to avoid contami-

nation as well as significant variations in temperature.

New Eppendorf solutions for stem cell research

Eppendorf has recently introduced two novel product solutions which are specifically geared towards increased reproducibility in the area of stem cell research: the new CellXpert® family of CO₂ incubators and the CCCadvanced® FN1 motifs coated cell culture vessels.

Experience Eppendorf

Once again in 2019, Eppendorf will be represented at the Labvolution®, where the entire world of the laboratory – from application to research, from the chemical industry to the life sciences – can be experienced first-hand. The exhibition takes place in Hanover, Germany, between May 21st and May 23rd, 2019.

Visit the Eppendorf booth in exhibition hall 20 / booth B69 and be inspired by the versatility of the Eppendorf product range, designed to make your work in the laboratory easier and more efficient. With this goal in mind, Eppendorf develops products and solutions in the areas of Liquid Handling, Cell Handling and Sample Handling.



Over the past two decades, a variety of research fields has experienced significant growth thanks to the availability of stem cells. In addition, the number of clinical studies which evaluate the use of stem cells in degenerative diseases such as, for example, Parkinson's, has increased within the last few years. Cell cultivation has played a crucial role in the process.

Current challenges

Independent of their origins, two characteristics of stem cells are of significance: on the one hand, the fact that they continually renew themselves and proliferate, and on the other hand, their ability to differentiate into different cell types. Currently, these properties happen to be the source of the greatest practical challenges in stem cell culture as well as during downstream applications.

WHAT'S NEW



Inside Cell Culture Newsletter

You are experienced in cell culture and want to keep improving your knowledge? Maybe you are also looking for better resources that support your teaching and training? Then the Eppendorf "Inside Cell Culture" Newsletter is just perfect for you.

Get regular information about:

- Tips and tricks to improve your daily work
- Free videos, downloads, posters and more
- Access to advanced educational webinars
- Teaching support resources
- Upcoming events and trainings

Learn more and sign up here:

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384... Ready. Set. Pipette!

Ever higher throughput, ever smaller sample volumes in the daily laboratory routine? More and more frequently, this trend forces researchers to replace 96 well plates with 384 well formats.



Effortless pipetting in 384 well plates
A whole plate in just 1 minute - 24 or 16 wells in a single step

It is understandable if scientists prefer to avoid this replacement, as manual work involving the 384-well format is no picnic, and automation is not always a feasible solution. Who is not familiar with the cumbersome “staggered pipetting” using 8 and 12 channel pipettes? This common technique requires extreme concentration; it is time-consuming, and it carries a risk of error – particularly under stressful conditions.

There is a solution – goodbye cumbersome staggered pipetting

Eppendorf has developed a novel system that is optimized to work perfectly in combination with 384 well plates. The system comprises mechanical and electronic pipettes with a choice of 16 or 24 channels, as well as the innovative epT.I.P.S.® 384 pipette tips. In just one step, 16 or even 24 wells can be filled in parallel – ideal for simultaneously starting or stop-

ping of up to 24 reactions. It is now possible to master a 384 well plate in as little as one minute. It is worth it. How much time would you save per plate?

The innovation – epT.I.P.S.® 384 with SOFTattach Technology

But there is more at stake than time; the tiny delicate wells of a 384 well plate require special attention and finesse. Standard tips that are ideal for 96 well plates now appear too chunky for 384 well formats. The new epT.I.P.S.® 384 with their unique SOFTattach Technology thus provide the best possible peace of mind. For the very first time, elastic forming grooves are used which are capable of adapting perfectly to the pipette cone. In this way, they secure an exceptional tip fit and therefore a reliable seal of the entire system. Even the dispensing of liquid into plates is now possible without the risk of individual tips detaching from the cone.



Whereas previously, the utmost concentration was required to avoid accidentally filling the wrong well, smooth and steady pipetting is now possible, even under stressful conditions.”

Customer opinion

Ergonomics – workplace innovation

It is our philosophy to continually improve the working conditions of our customers. Our focus is always on the needs of scientists. To this end, we regularly challenge the status quo of our products.

For example, the Eppendorf PhysioCare Concept® is reflected in the spring-loaded tip cones of our manual pipettes – these ensure a secure, reproducible tip fit. Haptic feedback provides security, and it renders repeated beating down on the tip box obsolete. Moreover, the PhysioCare Concept is represented in the SOFTject Technology, which enables stepwise ejection of tips from multichannel pipettes, and which thus reduces the forces exerted during the ejection of tips by 50 percent.

With the new system of pipette tips for 384 well formats, Eppendorf has significantly enhanced this ergonomic concept. The forces required to

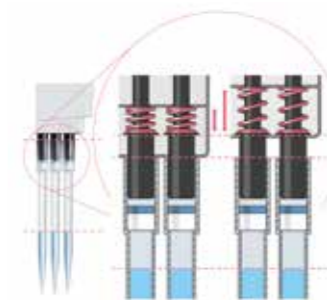
attach tips were reduced by a further 40 percent per cone thanks to the innovative SOFTattach Technology. An extremely fine tip shape, paired with excellent concentricity of the tip, turns maneuvering of the tiny and delicate wells of a 384 well plate into a surprisingly positive experience. ■

INFOBOX



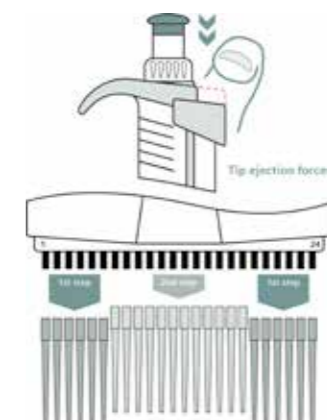
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My Second Chance



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Shekhar Chandra is a PhD candidate in environmental policy and 2017 Lawrence Susskind Fellow at the Massachusetts Institute of Technology in Cambridge.

I thought that attending a top-ranked university in the West, and especially the United States, would be a guaranteed ticket to success. I was also eager to help the world by studying the impact of pollution on the global environment. As a child growing up in a remote village in India, I had seen some of these effects myself, such as how indoor air pollution from cooking leads to health problems and how changing weather patterns affect farmers' crops. I hoped that the atmospheric science research I planned to pursue could help improve the lives of my family and friends back home and the many others in similar situations. So, when I arrived in the United States in 2007 to start my PhD, I was ready to put my head down and get to work.

But within my first semester, I began to have doubts. My research seemed unlikely to lead to the real-world change that I sought, and my intellectual satisfaction with my work started fading. Strangely, my newfound freedom to explore a range of interests – very different from what I had experienced as a student in India – fueled my dissatisfaction. Besides pursuing my doctoral training, I was excited to take courses in a variety of disciplines, including civil and environmental engineering and public policy. But I found that I was more engaged in class discussions than with my research colleagues, which made me question where my research and career interests truly were.

I was faced with a choice. Should I continue pushing forward in an endeavor that I was no longer sure was the right fit, or should I abandon my PhD to return to India and take some time to figure things out?

My family and friends discouraged me from leaving. They thought I was risking both my career and the livelihood of my family, whom I helped support with my doctoral stipend. Nonetheless, about 2 years in, I concluded that I would never be satisfied with my work if I didn't make a

change. Even though leaving my program would bring trade-offs and uncertainty, it was better to find the right fit than to risk a lifetime of career frustration and disappointment.

My family's dreams were shattered. Most of my former colleagues and mentors started ignoring me. My confidence was shaken when I was out of a job for months and my harum-scarum decision left me and my family struggling. Seeing my colleagues and friends racing ahead in their careers while I was still unsure about what I wanted also made me doubt my decision.

Eventually, I got a job in governance with India's Planning Commission. It was completely unrelated to my previous work, but – as with my initial interest in atmospheric research – I had a personal stake in the topic. Growing up in India, I had experienced governance failures at many levels, including education, health, and other essential services, and I was enthusiastic about the opportunity to improve the situation for others. After four years of working for the commission, I realized that I am more interested in solving development challenges through policy than through the "hard" scientific research that these policies build on.

With this new perspective, I decided that I needed to go to the United States to pursue my doctorate – again. I'm now happily a PhD student once more, and I'm confident that this time I've found the right fit.

I could have saved precious time and resources if I had explored more before embarking on my first doctoral program. Yet, that experience helped teach me how I want to spend my career, so I don't think of the time as wasted. It also taught me how important it is to evaluate how I feel about my work along the way and whether it is bringing me intellectual and personal satisfaction. Going forward, this mindset will help me explore, take risks, and ultimately find work that is deeply rewarding. ■



Trails of Life

“Photographer of the Year 2018” – Roberto Bueno is delighted with the title. With his image, he captured the motto of the competition “Patterns in Nature” perfectly.

About the winner and its master



“The forests of the North are beautiful in autumn, with the variety of colors of the trees. A little larvae is an autumnal surprise in the northern woods of Alaska and Yukon”, says Roberto Bueno who took this picture in Whitehorse, Yukon (Canada). “The feeding behavior of aspen leaf miner (*Phyllocnistis populiella*) larvae, on the leaves of aspen (*Populus tremuloides*), make interesting patterns, with intricate trails on every leaf. The floor of the yellow forest becomes a new world to enjoy nature. The little trails that these larvae make on the surface of the tree leaves are amongst the most surprising patterns I have seen in the natural world.”

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“Capturing Movement” is the theme of this year’s Royal Society of Biology Photography Competition. Life on Earth is constantly changing, and photographers are invited to take a photo of nature in motion. Supported by Eppendorf, the competition has two age categories: 18 and over and under 18s. The contestants may submit up to three images by July 26, 2019!!

www.rsb.org.uk/photocomp





Leopard Gecko

It was the eyes of the gecko that fascinated Jack Olive – and he pressed the release. His photograph earned him the title “Young Photographer of the Year 2018”.

About the photograph and its young master

“The leopard gecko stared down the lens allowing me to take this picture” says 17 years old Jack Olive who took the picture in Devon, United Kingdom. “I also wanted to show the yellow and black scale pattern as well as the beautiful eye.”

His image fits with the theme of the competition (“Patterns in Nature”) as the array of yellow and black scales contrast brilliantly together and the eye shows magnificent pattern and detail.



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