Off the BENCH

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The Eppendorf – LifeScienceStyle Magazine

p. 6 Studying the Brain with Italian Passion

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MASTHEAD

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Editorial

Dear Reader,

"In order to be successful today, one must be adaptable and prepared to continually think, revive, react and invent anew", Bill Gates once said. Agile work promotes this belief, as it is more important than ever in this global and increasingly digitized economy to adapt quickly to the changing needs of clients and markets. Agility is therefore more than a buzzword – it allows companies to secure their success in the long term.

Working in an agile fashion requires a fresh mindset and a new way of working, at all levels within a company. Flat hierarchies support autonomous action. Short planning and implementation cycles, along with deeper involvement of all employees and customers, promote speed and the power of innovation. All these measures will contribute to a forward-looking company culture.

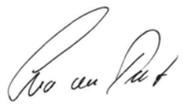
We at Eppendorf are convinced: with our agile Innovation Process, we will accelerate product development, based on customer centricity. And our "be Eppendorf 2021" transformation will enhance and straighten our positive company culture.

Within our inspiring company culture, diversity is an indispensable value and ingredient. Equality between men and women and equality among people of different backgrounds and cultures, not only opens up new opportunities for each individual employee – it is the diversity of talented people that contributes significantly to the success of our company. And science is no different – which is why we dedicate a major article in this issue of "Off the Bench" to the topic of diversity – starting on page 14.

The opportunity to express oneself and spread one's wings, to receive support when it matters most – Flavio Donato knows what he is talking about. At the Norwegian University of Science and Technology in Trondheim, the neuroscientist and native Italian studies the secrets of our human brain with great fervor. His passion earned him the 2018 Eppendorf & Science Prize for Neurobiology. See the whole interview on page 6.

In our next issue in April Prof. Dr. Andrea Ablasser, winner of the 2018 Eppendorf Award for Young European Investigators, will talk with us about her contributions to a key step in the innate immune response, which triggers a frontline defense when cells are attacked by microorganisms.

We hope you will enjoy the read,



Eva van Pelt
Member of the Management Board
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New Insights

A bite with consequences
During the course of their studies of malaria, scientists continue to come across new findings and ways to treat the disease

Fighting against Malaria

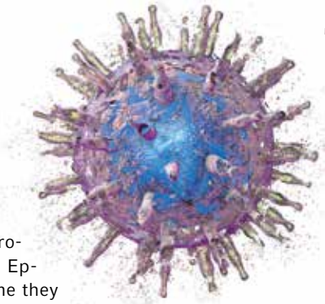
People who are infected with malaria smell different from healthy. Researchers have recently discovered that certain scent molecules of the malaria parasite, *Plasmodium falciparum*, are responsible for this phenomenon. These aldehydes attract the insect vector which transmits the disease – the Anopheles mosquito, as shown by experiments conducted using socks from infected children and healthy children.

These results will now be able to help develop chemical traps to capture the Anopheles mosquitoes as well as improve diagnostics of the disease. Another critical victory in the fight against malaria was achieved by a Chinese team of researchers. The team was able to modify the genes of the sweet wormwood plant, which is the source of the active ingredient artemisinin, in such a way that the content of the active ingredient was increased to multiple times that of the wild type. This higher yield is supposed to help satisfy global demand for malaria medication which would, in turn, positively influence the market price.

Viruses for Eyes

Viruses can soon be employed in gene therapy of eye diseases. A current study conducted at the University of Tübingen confirms that adeno-associated viral vectors function as a kind of transport system in order to introduce nucleic acids carrying healthy genetic information to the respective cells. The beauty of adeno-associated viruses (AAV): they belong to the genus of Dependoparvovirus and are therefore incapable of procreating and causing further disease.

Multiple Disease Trigger



Roughly 95 percent of Europeans are infected with Epstein-Barr virus by the time they turn 30. Until now, this virus has been known as the causative agent of mononucleosis. Researchers at Cincinnati Children's Hospital have now discovered that the virus plays a role in the development of seven additional illnesses. It conveys an increased risk for the development of lupus, multiple sclerosis, type 1 diabetes, celiac disease, inflammatory bowel syndrome and two types of arthritis.

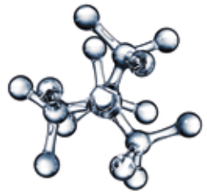
Trendsetter Blockchain

Everyone talks about it: blockchain – primarily known as databases from the Bitcoin universe – are now in the position to conquer the food industry as well the realm of medicine. The information carrier can be used to better track the origin and processing of food, and in the field of medicine, blockchain could help transmit private patient information safely and securely. Until now, however, only pilot projects have been tested, and many questions, especially those pertaining to data protection and privacy, remain unanswered.

31,000

This is the number of academics at British universities that hail from European countries and could thus lose their right to remain in Great Britain following Brexit. Basic research would be particularly affected: 16 percent of university researchers originate from non-EU countries.

New Code



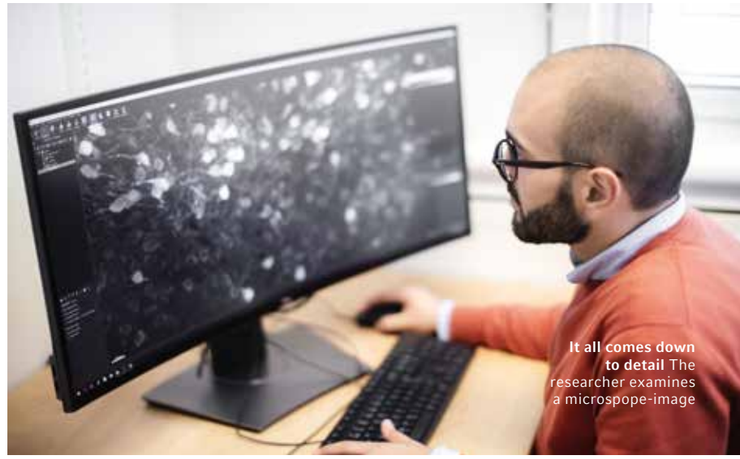
Each coding system has one weak link: the password. Scientists at the Karlsruhe Institute for Technology (KIT) have now combined a common coding method with a chemical password. To this end, the password, in the form of organic molecules, is rendered invisible to its environment and sent to the recipient separately, ensuring that the digital data cannot be hacked during transport. This newly developed process is touted as so secure that it is even suitable for secret service information, which would justify the extra effort of encryption.

Always cheerful and highly motivated Flavio Donato tackles the exploration of the many remaining secrets of our brains with enthusiasm and passion

Understanding the Inner GPS

RESEARCH CAREERS

With the passion of a Southern Italian, Dr. Flavio Donato studies the human sense of direction and memory in Trondheim, Norway. At the same time, the neuroscientist explains what the design of the human brain has in common with an IKEA® cabinet.



It all comes down to detail The researcher examines a microspope-image

Our heads host what is probably the most mysterious and complicated structure in the universe. Anyone who sets out to understand and really decode it must do so with an extra dose of passion. Who could possibly be more destined for the study of the brain than an Italian? With boundless empathy and practically endless curiosity, Dr. Flavio Donato studies the user manual of our brain at the Norwegian University of Science and Technology in Trondheim. “This ordered chaos of neurons and synapses, with input from the outside that creates branches and tracks”, as he lovingly describes the human brain. However, it is not only its operating principle that drives the neurobiologist. Most of all, Flavio wants to understand the connection between our experiences, our thinking processes and our perception.

A package of components: sorted in the right order

This is much easier if even highly complex issues are approached in typical Italian fashion: with a degree of ease. The 35-year-old scientist already has an example at hand which he uses to explain the structure of the brain: “It resembles the assembly of an IKEA cabinet!” “What?” What does the complexity of the brain with its 86 billion cells have in common with the comparatively simple assembly of Pax or Ivar? Flavio laughs. “The assembly of a cabinet begins with a box full of independent components. All parts must be assembled in the correct order so that they can cooperate and thus fulfill a specific purpose.” Boards, pins, slits – each component on its own is useless, whereas all of them have a specific function, with one goal: the cabinet! Our brain contains a similar package of components (neurons) that belong to different functional units (cortical areas). They, too, must be connected in the correct order to create expanded circuits which, in turn, support cognitive functions. This is neuroscience, in a nutshell!

A life dedicated to science

On the trail of the unknown, discussing something new and perhaps even redefining the world – even as a child, Flavio’s heart was beating for the discipline of curiosity. Having grown up in the idyllic world of a small village in Calabria, where ►

Inspiring Science

We now have the technology to understand how a neuronal circuit functions. Once we understand how the brain functions, we will be able to repair it more quickly."

lemon trees bloom and family is not simply a shell of a word, he decided "at a very early age to dedicate my life to science". Two older brothers, "la Mamma" and his father supported him in his quest to blaze new trails in order to perhaps even make his mark: "They encouraged me to pursue my dreams and be bold about my aims", says Flavio.

After high school, Flavio studied in Rome where he completed his Bachelor in Biotechnology and his Master's degree in Genomics and Proteomics at Sapienza University. For his PhD, the young scientist moved to the Friedrich Miescher Institute in Basel, Switzerland. "I really wanted to study neuroscience and the group of Pico Caroni was heading into an exciting direction by studying how synapses are made and dismantled in response to experience", remembers the scientist. Flavio was finally ready to tackle the most fundamental question of our very being: "What makes us who we are?"

In order to solve this mystery, one has to observe the brain during childhood. "A child's brain is probably the most powerful learning machine that exists in the entire universe. It learns an incredible amount of information – from how to move in the environment, to speak a language, make plans and interact with people, in a very limited amount of time and with great flexibility." Flavio is enthusiastic, and he discloses his dearest wish as a researcher: "If we could understand how the child brain uses the immense potential of plasticity, we could dream of harnessing that potential to shape the adult brain in pathological conditions. That to me is a dream worth chasing."

A neuronal map is created

The focus of his current work as a postdoc in the laboratory of Nobel Laureates Professor May-Britt Moser and Professor Edvard Moser at the Kavli Institute in the Norwegian city of Trondheim is the study of the brain with respect to its ability to remember and orient oneself. Who am I? Where do I have to go? Flavio describes the human sense of direction as a complex interplay between different types of brain cells: "In the entorhinal-hippocampal system in fact, multiple populations of neurons are connected to each other in a neural network that spans the medial temporal lobe."

The network is creating a neuronal map for itself that shows us the way from A to B, similar to the GPS system in the car: "Each of these populations of neurons is specialized to represent a specific navigation-related variable!" The "place cells" store maps of places that we have visited. The "speed cells" measure the speed at which we move. The main actors, the "grid cells", act as an internal GPS. "They calculate distances and help us track where we are." Additional actors include the "head direction cells" that give us direction, like a compass. Last, but not least, the "border cells" keep us from walking into walls. "This is a dead end. Go find another way."

"Star cells" send out signals

Flavio is just a little obsessed with detail, tease his friends, and is someone who never lets go but continues to dig even deeper. Once again, the neuroscientist displays Italian serenity. After all, his motto "stick to it, don't let go" rewarded him with the 2017 Eppendorf & Science Prize for Neurobiology, endowed with $ 25,000. It was the reward for being the first to be able to prove that during development, so-called star cells in the cerebral cortex send out an activity-dependent signal. This leads to the maturation of those neurons that are later involved in the development of our sense of direction. It was such a spectacular discovery that opened up new avenues for the study and treatment of diseases such as dementia and Alzheimer's. This is due to the fact that star cells are among the first to be affected by cell death and plaque in the case of illness involving memory loss. "We now have the technology to understand how a neuronal circuit functions", says Flavio, and he adds enthusiastically: "Once we understand how the brain functions, we will be able to repair it more quickly."

Setup for surgeries
Picture above: A manipulator that Flavio uses to direct the glass pipette with micrometer precision. Picture below: The probe that allows to see the target using ultrasounds

Microscope-image
Zooming in onto individual neurons and their synapses

New perspectives to understanding

What else does he delight in? "Observing a natural phenomenon, making a hypothesis about how it could come about and then putting in action the experiments that are needed to test the hypothesis. It is such an exhilarating feeling to know that you might have contributed, even in a small part, to the understanding of the inner workings of the brain! Typical Flavio! He cannot escape the skin of a scientist.

In the meantime, the Italian has discovered Norway's appeal. He loves exploring the countryside surrounding Trondheim or, reading and listening to music. If time were once again plentiful, he would not mind spending more of it playing the piano and the saxophone. But is science: "For me, the most fascinating discovery is not the one that fully answers a question, but the one that opens a whole new perspective of understanding", he says. So what comes next, Flavio? ■

THERE'S MORE:
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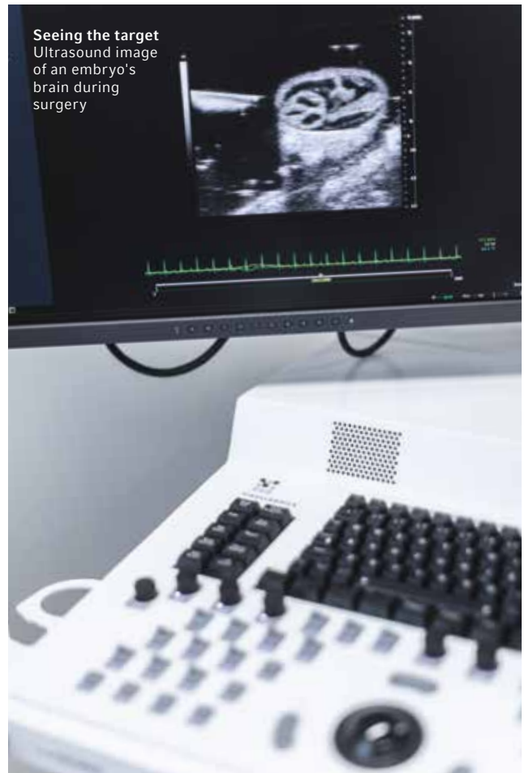


Seeing the target
Ultrasound image of an embryo's brain during surgery

With Prudence and Foresight

An appeal to sensibility
More often than not, laboratory work exerts a direct influence on our society

Science is not the preserve of the groves of academe; it operates right in the heart of society. In these times of rapid technological advances medical ethicist, professor and physician Giovanni Maio makes the case for maintaining a focus on lasting ethical values.

Professor Maio, science acts in the service of mankind. What points of contact does it have with society?

Giovanni Maio: A beneficent product of human rationality, science helps us to better understand the world around us and, to some extent, to free ourselves from the constraints of nature. It provides mankind with a degree of freedom that would not be possible without science and technology. But it has to be said that the laboratory as such does not operate in isolation, but from the heart of society. Technology is often an answer to visions which have their genesis within society, as well as sometimes revolutionizing ways of behaving and bringing new ways of living into the arena, something that would have been unthinkable without technology. Just spare a thought for the achievements of the pharmaceutical industry, such as contraceptives or information technologies.

We live in an age of rapid technological advances. Not only are innovations coming on line more quickly than ever before, but the consequences of these developments are also enormous. What role does ethics play in all this?

Maio: Every technological development conveys certain values. It is the purpose of ethics to actively point out these tacitly implied values and, building on them, to ask whether we as a society really want to promote these values or not. Nowadays, people often only strive to better what was previously possible, but without taking the time to reflect upon what it is that we actually urgently need. Overcoming existing boundaries is even automatically hailed as progress, but surely progress is more than merely expanding the scope of what is feasible. Science should not focus on what is technologically possible but should always learn to see the latter within the context of society as a whole. What we need is a culture that reflects on fundamental values – the kind of values that must not be invalidated by technology.

Where do you set the ethical boundaries of science?

Maio: It is definitely not enough to think: The main thing is to do something that was not possible before. Anybody wanting to advance science and technology also bears responsibility for the objectives pursued by these disciplines. We need to recognize that we can improve on and solve a great deal by using technology, but that the answers crucial to the problems

> *“It It is important for scientists to be made aware of the social implications of their actions and for them to establish their own sets of rules.”*

of the world are not normally to be found in technology. Instead, something of primary importance to society is surely how people deal with other people. Sometimes technology suggests that this approach is not of such prime importance. However, the unilateral proclamation of technological solutions – even for social problems – changes our understanding of the world. It leads us to see the world through different eyes and to handle this world in a completely different way than we would have done without technology. Digitization is a good example of this, as is robotics or the manipulation of embryonic genomes. The mere existence of this technology changes our attitude to the world. Technology is a certain approach to the world.

How do technologies such as digitization, for example, change science and its impact on society?

Maio: People act as if digitization makes everything faster and existing boundaries easier to transcend. But this technology changes more than just that – it changes everything. It suggests that direct communication is outdated and makes for completely different forms of communication; essentially, technology leads to a disembodiment of communication. Not only is this a loss, but we also need to think about something that should not become lost as a result of this change – our feel for the importance of human beings and the direct contact and communication between people. This is something that we need to think about, but not in the sense of making a blanket criticism of technology, which would be anything but credible. On the contrary, it is important to reflect on the matter in order to achieve that which technology most needs – a thoughtful approach to the subject. Just describing digitization as a silver bullet without alternatives is too ill-considered.

In view of the immense current pressure to be more innovative and to stay ahead of the game, criticisms are often voiced that the majority of research is conducted in areas where there is money to be made. With this in mind, are ethical considerations bound to fall by the wayside?

Maio: Not necessarily, not by any means. Firstly, we can be truly grateful that Germany boasts so many companies that are prepared to invest serious amounts of money in bringing innovative technologies to market, technologies of the kind that nobody else would have developed. Many private companies are driven by the positive feeling of doing something groundbreaking for society. They are not only investing vast amounts of capital, time and manpower; they are also risking a great deal. That is something that we should, in the first instance, appreciate. The fact that products can earn companies money is not a problem in itself. Companies only overstep ethical boundaries when money becomes the sole objective and they lose sight of the social significance of technological innovations.

Your appeal to science and society would be ...?

Maio: It is important for scientists to be made aware of the social implications of their actions and for them to establish their own sets of rules. Responsible scientists need to send out the message that they are prepared to adhere to voluntary commitments. Science really does have a big interest in adhering to voluntary commitments, because it is dependent on social acceptance. If science did not claim to adhere to ethical maxims, society would withdraw its trust in and thus its financial support of the discipline. This would be the end of science’s independence. We therefore need to invest far more in holistic training for our natural scientists, engineers, pharmacists and medical doctors, because if they learn more over the course of their studies than mere scientific facts, if they are made aware of the social significance of technological innovations, then this is the best guarantee for the emergence of a technology where vision is coupled with sound judgement. ■

Professor Dr. med. Giovanni Maio, Born in 1964, Prof. Giovanni Maio is a physician and philosopher; he holds the Chair in Medical Ethics at the University of Freiburg. He is a member of various ethics committees, advising the German Federal Government, the German Medical Association and the German Bishops’ Conference. October 2018 saw the publication of his new book “*Werte für die Medizin*”. His other publications include: “*Mittelpunkt Mensch. Lehrbuch der Ethik in der Medizin*” and “*Medizin ohne Maß? Vom Diktat des Machbaren zu einer Ethik der Besonnenheit*”.

The Alternative Is Liquid

Greenhouse gas-reduced e-fuels will be able to contribute significantly to climate protection. They combine the advantages of heating oil, gasoline, diesel and kerosene with those of renewable energy sources. Insights into the possibilities of tomorrow.

The oil of tomorrow
Synthetically manufactured fuels are climate-friendly

Manufacturing chemical products, driving cars, heating houses – without having to resort to coal, natural gas or oil – it sounds like the distant future. Even the world-renowned report "The Limits to Growth" dating back to 1972, which was prepared by the team surrounding economist Dennis L. Meadows for the Club of Rome®, founded in 1968, postulated the imminent end of the era of oil and urged the industrialized nations to develop effective measures to ensure climate protection.

Climate-neutral energy source
Today, almost 50 years on, the International Energy Agency® (IEA) is not predicting imminent oil shortages: the scenario "Sustainable Development" of its World Energy Outlook 2017 describes that by the year 2040, the proportion of oil, gas and coal will still approximate 60 percent. At the same time, the report substantiates the assumption that the combination of energy sources will increasingly be dominated by renewable energies. E-fuels will play a key role in the production of climate-neutral fuels.

E-fuels are synthetically derived liquid energy sources that are meant to replace fossil fuels in the long term, in an environmentally friendly manner. The areas of application are manifold, encompassing industrial production, oil heating, airplanes and shipping – but primarily vehicles. The study "E-fuels – The potential of electricity-based fuels for low emission transport in the EU" by the Association of the Automotive Industry (VDA) investigated the measures and investments that are required to achieve a 95 percent reduction in greenhouse gas emissions resulting from traffic across Europe. One of the pivotal results: even in a strongly battery-based traffic scenario, more than 70 percent of the total energy demand of all modes of transportation within the EU will be covered by e-fuels by 2050. "The energy required for the transportation sector is very high, and studies have provided impressive evidence that we are in fact in dire need of synthetic fuels if we eventually want to achieve 80 percent and more CO_2 reduction in the transportation sector", confirms Professor Stefan Pischinger, Head of the Faculty of Combustion Engines at the RWTH Aachen University®.

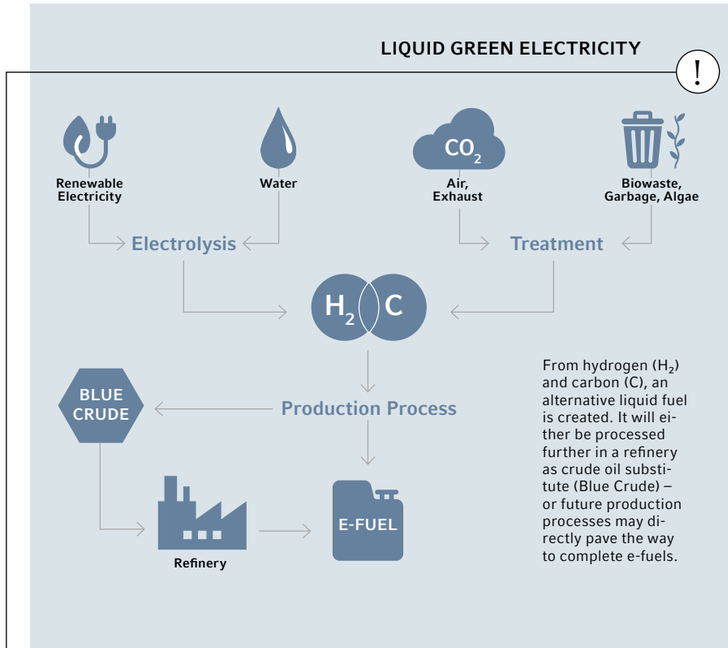
Market of the future: e-fuels
In this "enormous market of the future", as Pischinger describes it, research concentrates on the development of greenhouse gas-reducing substitutes for diesel, heating oil, kerosene and gasoline. Norway is taking the lead: the industrial park Heroya is currently the site of construction of a gigantic production plant, which is set to supply the chemical sector, the mobility sector and others with the climate-neutral crude oil-substitute "Blue Crude", starting in 2020.

The synthetic fuel is created via a three-step power-to-liquid (PtL) process from water and CO_2, with the aid of eco-friendly hydroelectric power, which is inexpensive in Norway. Further processing in existing refineries will yield environmentally friendly gasoline and diesel, as well as kerosene and rocket fuel. According to the operator, the cleantech company Nordic Blue Crude, the projected annual production of synthetic fuel would be able to power, for example, 13,000 passenger cars and thus prevent the emission of 21,000 tons of fossil CO_2 emissions.

> *"Even in a strongly battery-based traffic scenario, more than 70 percent of the total energy demand of all modes of transportation within the EU will be covered by e-fuels by 2050."*

The transport and storage challenge
E-fuels are important to the energy system's transformation for one additional reason: their very high energy density significantly simplifies storage and transport. In fact, the greatest challenge of renewable energies consists of transporting the generated electricity in a climate-friendly fashion with minimal loss as well as storage of excess energy. This is where e-fuels are attributed special significance. A separate research branch is taking on the challenge of producing fuels in sufficient quantity as well as consistent quality from agricultural waste material such as straw and grass, which do not compete with food production, through the biomass-to-liquid (BtL) process. As such, the EU project BioMates® strives to employ basic biological materials instead of crude oil for the first time on a large scale in the refinery process in order to directly produce a fuel substitute.

Increasing the efficiency
According to Professor Stefan Pischinger, one of the bigger challenges facing the production of synthetic fuels is the fact that one must produce substantial amounts at reasonable cost. "Most of all, we have to reduce the energy demand of fuel synthesis, meaning we have to increase the efficiency", says the mechanical engineer. Germany as a research base is one of the drivers; however, climate change does not stop at the border. According to Pischinger, "The large research groups including, for example, the Cluster of Excellence 'Custom Fuels from Biomass' at RWTH Aachen University and the large research alliance 'Co-Optima' in the USA, exchange information pertaining to their processes at conferences on a regular basis." In the future, the world will not be able to manage without climate-neutral liquid energy sources – on this fact, everyone agrees. ■



Harnessing potential
In order to achieve more diversity in research, it is paramount that talented female scientists be promoted

Diversity at the Top

Superb science needs diversity. According to studies, mixed teams produce better research results and women broaden the spectrum of topics. Even so, they are a minority among top scientists. Unused potential that is worth tapping into.

She always entered the Chemical Institute of the Friedrich Wilhelm University in Berlin by the back door. To her as a woman, lecture halls were off-limits. Her research was conducted in a former woodworking shop. When nuclear physicist Otto Hahn eventually accepted the Nobel Prize for their joint research, the author of the first publication in theoretical physics that explained nuclear fission came away empty-handed. Even though it is a belated honor, today the courageous Lise Meitner is considered a role model for women in research.

In favor of diversity and against discrimination
Problems such as those faced by Meitner have long since been overcome by female researchers. Nevertheless, according to information provided by the Common Science Conference (Gemeinsame Wissenschaftskonferenz), German universities still operate according to the old principle: the higher the salary, the lower the proportion of women. Latest data indicate that the percentage of women professors in the C4/W3 bracket, the highest income bracket at German universities, amounted to 18.4 percent. Moreover, many women scientists abandon their careers once children arrive on the scene.

Dr. Sarah Wiethoff of the Hertie Institute for Clinical Brain Research at the University of Tübingen knows what she is talking about when it comes to the difficulties of juggling science and family. The 32-year-old brain researcher, and mother of two, focuses on rare neurological diseases. Such complex research takes time – and money for practical support such as domestic help and child care. "Conducting science successfully is a challenge – and with children it is easily twice as hard", says Wiethoff, who has recently been awarded the sponsorship prize "For Women in Science"®, which is presented by the German UNESCO® commission and L'Oréal Germany®, together with the Christiane Nüsslein-Volhard Foundation, to exceptional women scientists with children.

Diversity in science is more than an empty declaration of intent. Since 2006, the German Research Council (Deutsche Forschungsgemeinschaft (DFG)) has been striving for equal consideration of all applicants and project personnel, independent of gender and age, of disability, illness and sexual orientation. Despite these efforts, many scientists still hit a "glass ceiling" when planning their careers. "This fact not only stifles the careers of women and persons with disabilities, but also the careers of those with other characteristics. For instance, people with a migration background are confronted with a very thick glass ceiling", explains Biopsychologist and Leibniz award winner Onur Güntürkün in the research magazine of the German Research Council.

Bringing up the rear: Japan, Germany and Switzerland
Unlike in the US, where the battle about underrepresentation of African Americans and Hispanics in science is still raging, the discussion in Europe revolves mainly around gender equality. Rightly so. Too few female scientists manage to sustain successful careers. Worldwide, the "gender gap" is especially pronounced in the fields of informatics, physics, mathematics and surgery, write Luke Holman, Devi Stuart-Fox and Cindy Hauser of the University of Melbourne in the journal PLOS Biology. The researchers had searched the publication databases PubMed® and arXiv® for signs of gender-specific inequality. Apparently, particularly grave results emerged from Japan, Germany and Switzerland. The higher the per-capita income of a country, the more limited the chances of women to succeed in science, the researchers conclude.

The diversity advantage
Physicist Andrea Bossmann confirms these findings. "Our society is diverse, but the faculty culture of physics is not. Women continue to be severely underrepresented in the field of physics", says the founding member of the Lise Meitner Society which advocates for the equal treatment of women in the sciences and in mathematics. Meanwhile, it is common knowledge that diverse teams offer clear advantages; for example, according to a study conducted by the scientific publisher Elsevier®, women publish more than their male colleagues in the male-dominated fields. Women further broaden the scientific spectrum of topics as they often seek out their own niche.

The good news: according to data provided by the Common Scientific Conference, in Germany, the share of women is continually on the rise in all stages of their careers. The proportion of women, however, continues to decline with each step up the career ladder following commencement of their studies. Even in the USA, top female scientists are underrepresented, particularly within the STEM subjects.

The root causes are obvious. Young scientists must publish – a lot. They must attend conferences, and they must apply for funding. Those who conduct experiments easily work a 14-hour day – plus being present in the laboratory on weekends. Finding a substitute to cover parental leave is often impossible, as research projects are for the most part tied to individuals. Frequently, young female researchers face the tough choice between their career and children. ►

> *Our society is diverse, but the faculty culture of physics is not. Women continue to be severely underrepresented in the field of physics."*

Dr. Sarah Wiethoff
The German brain researcher and young mother was recently awarded the sponsorship prize "For Women in Science"

Programs for top female researchers
Universities and research institutions make an effort to improve the underlying conditions for female researchers and to consider diversity when awarding funding for research. "Criteria that do not concern science, for example age, gender and ethnic background, as well as religion, ideology and sexual identity, must not influence funding decisions", emphasizes Susanne Knoop, whose role within the German Research Council is to address questions of diversity. Numerous non-profit organizations support young female scientists in their careers. In the USA, for example, the Diversity Alliance for Science advocates for more diversity in the STEM fields. In Germany, the Christiane Nüsslein-Volhard Foundation supports female researchers in the area of child care, since, as the founder once said, if she had had children, in her mind her work would not have satisfied the requirements of the Nobel Prize. ■

Eva van Pelt, Chief Commercial Officer, Sales, Marketing and Service, on diversity at Eppendorf AG.

You care deeply about the topic of diversity – why?
Eva van Pelt: Whether it be research, industry or politics: diversity presents significant opportunity. Since I have started working in industry, I have been striving to promote diversity. The topic is multifacetted; it concerns gender equality, but it also has cultural, academic and social components. I have had the very best experience with diverse teams. They perform better, they converge better, and they deliver above-average results.

How can one achieve diversity?
van Pelt: I am convinced that diversity cannot be attained by purely organic means. I used to think that quotas were nonsense. Now I am convinced that they help us achieve critical mass. The head of human resources at a large German company once said to me: "If I need to fill a position, and our headquarters are staffed with 90 percent men, chances are high that one of them will look suitable." I have overcome my fear of the quota and the prejudice toward the so-called "token woman". There are enough female candidates with excellent education – one only has to reach them!

How do you promote diversity at Eppendorf?
van Pelt: We have already set ourselves targets regarding the share of women in leadership positions. That means we make a conscious effort and "go the extra mile" to consider and promote female talent when filling new positions. Therefore, we have taken up the responsibility to create working and cultural conditions that allow and enable our female talents to bloom and take leadership positions without compromising on their family life. This is just the starting point of a much more diverse world in science as well as in the industry. At Eppendorf we are committed to this.

A matter of heart: For Eva van Pelt, diversity is one of the top priorities at Eppendorf

Peak Cognitive Performance

They recognize words and numbers, they display skill and they plan ahead: how animals baffle science.

All Brain

The neuronal network of an octopus, with its 500 million neurons, spans the entire body, with two thirds of the network located within the arms. Their complex thought organ enables amazing cognitive feats that, as loners, they cannot have learned from others of their kind. The most prominent example of this includes opening screw caps – at which the octopus gets better at the more it is allowed to practice. These invertebrates are even capable of distinguishing people, as unpopular zookeepers on occasion end up with a splash of water in their face.

Learning is Fun!

Exceptionally intelligent species such as parrots and monkeys can learn the concept of numbers and are able to differentiate them. Recently, however, scientists have successfully trained bees to consistently approach a picture which displayed the fewest objects from a selection of pictures. The clever insects not only learned to distinguish between two, three and four, but they also learned to select a picture that contained no images at all. They evidently understand that zero is less than one – hats off!

Master Planners

The ability to plan events that lie outside the current scope of perception defines us as being human. Until recently, birds were thought not to have this ability. However, researchers at the University of Lund have since discovered that the common raven is capable of planning up to 17 hours ahead, including planning the use of tools and preparing to barter. In this regard, they are said to be equal to primates. The nucleus-like structures of their cerebrum contain twice as many neurons as the cerebral cortex of primates.

Unfairly Underestimated

To call someone a stupid sheep is totally unfair. Sheep are not only able to tell other members of their species apart by their faces, but they can also recognize human faces in a photograph, as demonstrated by using photographs of celebrities. Similar to cows, sheep learn to abstract: if their food is placed underneath a bucket of a certain color, they quickly learn which bucket is the right one. If the food bucket is then replaced with a container of a different shape, but of the same color, they are not fooled – they find their food just fine.

Brainless and Bright

Do trees communicate with their neighbors? Do plants react to music? Plant intelligence is a controversial term among botanists, as plants possess neither neurons nor a brain – nevertheless, they are smart. Things that clever plants can do.

Equipped with all senses
Researchers not only credit plants with incredible adaptability – but with real intelligence

More than a century ago, evolutionary biologist Charles Darwin is said to have exposed the plants in his garden to the sound of a trumpet. He wanted to find out whether they were sensitive to sound. At the time, the experiment did not bear fruit. While plants are incapable of hearing in the classic sense, they do perceive sound in the form of sound waves. Stefano Mancuso, plant scientist and head of the Laboratory for the Neurobiology of Plants (Laboratorio Internazionale di Neurobiologia Vegetale, (LINV)) at the University of Florence, explains in his book "The Intelligence of Plants": "Plants can perceive vibrations via mechanosensitive channels in their cells. The entire plant with all its parts, below and above the ground, can hear." Under the scientific guidance of LINV, and over a period of five years, the vintner Giancarlo Cignozzi from Montalcino played music by Mozart to half his grape vines. The vines that were exposed to the sound grew better, their grapes ripened ten days earlier, and their wine had a stronger taste and was also more intensely red in color.

Controversial field of study

According to Mancuso, the effect of music on plants is a proven fact. Not so much certain types of music, but rather certain frequency ranges influence their growth. "While mainly lower frequencies between 100 and 500 Hertz promote germination, growth and the length of the roots, higher frequencies exert an inhibitory effect", writes Mancuso. In a TED talk he explains: "Our speech, as well as music, is strong enough to stimulate plant membranes. The frequencies of the sound may well exert an influence on growth, even if this fact is not welcome by all scientists."

When Mancuso, together with other scientists and within the scope of a publication in the journal "Trends in Plant Science", introduced the new discipline of plant neurobiology, he was met with harsh criticism. Many scientists do not recognize the theses of plant neurobiology – the idea that anatomical structures and physiological processes in part correspond to those of animals. They consider the term"Neurobiology" to be misguided since plants, in contrast to animals, do not possess neurons. One of the critics is Lincoln Taiz, Professor Emeritus of Plant Physiology at the University of Santa Cruz. Among other issues, he reproached the plant neurobiologists for over-interpretation of data, anthropomorphizing and wild speculations. Even Charles Darwin, whose "root-brain" hypothesis, i.e. the assumption that the tips of roots act similar to the brains of lower animals that plant neurobiologists often refer to, was subject to criticism. The German botanist Julius von Sachs, who at the time conducted research at the University of Würzburg, was said to have called Darwin a "cottage scholar" and "dilettante".

Multitalented plant life

Mancuso writes: "Plants do not possess a single organ that even remotely resembles a brain as we know it from animals. Does this mean that we must dispute their intelligence?" He defines intelligence as the ability to solve problems. The fact that plants possess problem-solving competencies has been shown by means of a number of examples. If, for example, wild tobacco is gnawed by an insect, the injured plant cells recognize substances from the attacker's saliva. The plant is able to distinguish and fight up to 32 potentially threatening insect species. If the plant is eaten by the caterpillar of the tobacco hawk moth, which is resistant to the neurotoxin nicotine, it reduces nicotine production and instead ramps up the production of fragrances that attract bugs which will remove the caterpillars. According to the results by American biologist Ian Baldwin, the tobacco plant is capable of producing up to 144 different fragrances, as required. The head of the Max Planck Institute for Chemical Ecology in Jena has studied wild tobacco for decades in Utah's Mojave Desert.

Equally adaptable, the mimosa can distinguish harmless stimuli from potentially dangerous ones. The Australian botanist Monica Gagliano built a structure from which the plants, complete with their pots, fell to the ground 60 times in a row from a height of 15 centimeters. While the leaves of the mimosa plants closed up during the beginning of the experiment, they remained open after five or six falls.

Rooted in cleverness

Mancuso credits plants with the five human senses, as well as with 15 additional senses. For example, they can detect substances in the ground that are either particularly important or damaging to their growth, and they are able to measure the level of humidity. Beyond their sensitive faculties, plants also communicate with one another, as shown by forest ecosystems. The Canadian forest ecologist Suzanne Simard coined the term "Wood Wide Web". She was able to demonstrate that trees exchange nutrients and stress signals via a subterranean network of fungi. Simard injected Douglas fir trees with a radioactive solution, and days later she was able to detect the radioactive substance in neighboring trees. Individual trees showed up to 47 connections with other members of the same species. Even if plants possess neither neurons nor a brain, their intelligence is evident. ■

On the Hunt for Superfoods

Chia seeds, moringa powder, açai and goji berries – the list of foods that are traded as superfoods is long. The fact that demand far outpaces supply carries risks – among them the counterfeit trade. Genetic barcodes are expected to provide relief.

Health conscious consumers swear by so-called "superfoods"; after all, they are credited with numerous benefits, for example, immune-boosting, detoxifying or stress-relieving effects. Many of the berries, seeds or algae originate in exotic countries, and they are imported in dried form, as a powder or as juice. This makes them extremely versatile. For example, moringa enriches green smoothies, it refines salads and it provides the basis for the detox teas that are so popular these days.

According to one of the leading global statistics databases, Statista, in 2017, approximately 19 percent of all newly introduced superfoods worldwide were introduced to the American market – making the US the leading import country worldwide. Germany follows at nine percent and is thus the European champion. At six percent each, Canada and the UK, respectively, share third place in the global arena. The sale of quinoa, among others, registered an enormous upswing in recent years. For example, the amount sold in Germany increased from roughly 725 tons in 2015 to 1,094 tons a year later.

Out of balance: supply and demand

Due to recent popularity, the demand often exceeds the supply significantly. In their countries of origin, this often leads to monocultures that threaten the biodiversity of agriculture. The trend further impacts the diet and nutrition in the countries of origin: for example, in Bolivia, the price of quinoa has risen to such an extent that many local people can no longer afford their traditional staple. The consequence: people resort to alternative foods with often inferior nutritional and physiological qualities, thereby risking the dangers of poor diet and malnutrition in the long term.

Identifying the counterfeits

The import countries of the superfoods, too, are affected by the high demand as it encourages the market for counterfeit products. While information on origin and nutrition is listed on every package, the more exotic a food, the more difficult it is to determine whether it is in fact the original. Even experts may find it difficult to detect a counterfeit, as superfoods are often plants that cannot be competently identified by anyone. In order to protect consumers from counterfeit products, plant-based foods are tested for authenticity upon import. "If you have a powder in front of you, as is often the case with chia, which, by the way, belongs to the sage family, this method will not help you", explains Professor Peter Nick of the Botanical Institute for Technology in Karlsruhe, Germany (KIT). Together with his team at KIT, he develops genetic barcodes that will expose the lookalikes of superfoods.

In greenhouses, the botanists from Karlsruhe grow the original plants that are processed to become superfoods, as well as those that due to their similarities to the originals may serve as counterfeits. The process developed by Nick and his team utilizes small differences between the genetic sequences in order to cut DNA strands with gene scissors in a specific, targeted fashion. Such gene scissors fit – exactly as a key fits into its lock – only a specific gene sequence and thus generate a specific pattern of gene fragments. This pattern then serves as the genetic fingerprint of a given plant species – comparable to a barcode that is read by a scanner.

The advantage of this method is that it also works on processed plants, such as powder or juice. At this time, a total of 7,000 barcodes identifying superfood plants and their counterfeits comprise the database. Up to four different counterfeit species have been identified for chia seeds alone, including basil seeds, sesame seeds and amaranth.

Protecting the consumer

In addition to deceiving consumers, the counterfeit trade also poses certain health risks. Sensitive people in particular can suffer from allergic reactions without any idea what causes them, thus endangering consumer safety. This is a fact to which Nick and his team are now sensitizing officials and consumers and that they aim to counteract with their research. ►

Sought after worldwide
Optically appealing, attractive in taste and boasting convincing health benefits – Quinoa

Quinoa

What is it?
Quinoa is a gluten-free crop from the Andes region of South America, and it belongs to the Amaranth family.

What is in it?
Essential amino acids, polyunsaturated fatty acids, minerals such as magnesium, iron, potassium and calcium.

What can it do?
Boosts the energy metabolism, prevents vasoconstriction and acts as a mood enhancer.

Moringa powder

What is it?
It belongs to the family of Moringaceae and originates in the Himalaya region of northwestern India.

What is in it?
Fiber, antioxidants and vitamins, mostly vitamin E and B vitamins.

What can it do?
It protects the cell membrane from oxidative damage, and it relieves stress, strengthens the immune system and supports circulation.

Goji berries

What are they?
The original home of the coral red berries was located between Southern Europe and Western Asia; today the fruit is cultivated in China.

What is in them?
Mostly B vitamins, but also carbohydrates, fiber and protein, as well as the secondary plant products lutein and zeaxanthin.

What can they do?
Strengthen the immune system, heart and eyes, act as anti-inflammatory and protect the body and skin from aging.

Chia seeds

What are they?
Chia is a member of the genus Salvia – *Salvia hispanica*, and it originates in Central America. The seeds are considered the superfood.

What is in them?
Proteins, lots of fiber and polyunsaturated linoleic acids. Also, potassium, iron and antioxidants such as phenolic acids.

What can they do?
Chia seeds stimulate digestion. They quell in the stomach, have lasting satiating effects and can thus aid in weight loss. Omega-3-fatty acids strengthen the cardiovascular system, and antioxidants act as anti-inflammatories.

Açai berries

What are they?
Açai berries are the fruits of the Açai palm that grows in South America, particularly Brazil.

What is in them?
Many antioxidants, also vitamins, minerals and essential fatty acids.

What can they do?
Açai berries boost metabolism, protect from radicals and thus slow the aging process.

What Are the Powers of Superfoods?

Vitamins, minerals and proteins – superfoods supply the body with goodness. But which food contains what?

Hot Winter Chocolate with Chili

Bring your own Recipe

INGREDIENTS

2 red chili peppers
7 cardamom pods
200 g dark chocolate
250 ml whipping cream
1 Tbsp vanilla sugar (or 1 Tbsp granulated sugar and ½ tsp vanilla extract)
400 ml milk
Chocolate shavings, to decorate
Chili pepper, to decorate

This is a recipe tip tried out by our editorial team!
We love it!
Try it and let us know if you liked it!

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

magazine@eppendorf.com

1 Cut chili peppers lengthwise in half, remove the seeds and finely dice. Remove the seeds from the cardamom pods and mince. Cut chocolate into small pieces. Whip 200 ml of the cream with vanilla sugar until stiff and refrigerate.

2 Bring 50 ml whipping cream with the diced chili and cardamom to a boil. Add chocolate to the cream and allow mixture to dissolve in the milk.

3 Fill the hot chocolate into glass mugs, pour the cream on top and garnish with chili pepper and chocolate shavings. Serve immediately.

Who Wants to Live Forever?

Those who are born today have a good chance of living to be a hundred years old, or even older. The mechanisms contributing to a long life are the subject of intense study by scientists worldwide.

A gray-blue swimming pool with a fountain, in the midst of the Arcadian landscape: on one side of the basin, naked women with white hair and wrinkled skin step into the water. After frolicking in the water, they emerge as young girls. "Fountain of Youth" is the name of the painting that dates back to 1546 and which is now on display at the "Gemäldegalerie", an art museum in Berlin. With this work, the Renaissance painter Lucas Cranach the Elder homes in on a topic that has inspired the imagination of humankind since time immemorial: eternal youth and immortality. While a fountain granting everlasting life does not exist, human life expectancy continues to rise. 3.2 million people a hundred years old or older are projected to be alive by the year 2050.

The oldest person known to be alive is Kane Tanaka who lives in Japan. At her age of 115, she is considered to be what is known as a supercentenarian – the term for a person who is at least 110 years old. At this time, there are between 300 and 450 supercentenarians worldwide. According to the Guinness Book of Records, the oldest man alive is 113-year-old Masazo Nonaka, also from Japan. He was born in July 1905 – the year that Albert Einstein published his theory of relativity.

Anchovies, rosemary and exercise

The concentration of the oldest humans in Japan is not a coincidence. According to statistics, the number of those over 100 years old is close to 70,000, and the numbers are rising. The reasons for this extraordinary longevity are the subject of study by cardiologist Makoto Suzuki in the "village of centenarians", in Ogimi, located on Okinawa, the southernmost Japanese island chain. The most important factor is the diet, says the researcher. The traditional Ogimi diet contains a lot of fruit and vegetables and very little meat, fish and eggs. It is said to be low in fat, with higher carbohydrate content than the dishes served on the Japanese mainland. Furthermore, people follow the directive of "Hara hachi bu" that recommends to stop eating as soon as the stomach is approximately 80 percent full.

Living as long as Methuselah
According to researchers, humans can live to a biblical age by following a balanced life style with healthy nutrition

The Italian fishing village Acciaroli, south of Naples, too, is home to a number of people who are one hundred years old or older. This is where cardiologist Alan Maisel of the University of California, San Diego, is on the trail of the secrets of longevity. "If you want to do as the people of Acciaroli do, you must eat more rosemary and anchovies", he says. "Breathe as much fresh air as possible, move, reduce your body weight and avoid stress."

The older the organism, however, the more seldom its cells divide. At some point, the cells cease to divide altogether, and the body dies. The approximate date of the death of a cell is written in its telomeres. Similar to a fuse, telomeres constitute the ends of the chromosomes within the cell nucleus, and they shorten with each cell division. The life of a cell ends once its telomeres have become too short.

Freshwater polyp of biblical age

One organism is said to have lived since the beginning of time: Hydra. The crown of tentacles of this freshwater polyp, which is as thin as a pin, is reminiscent of a dandelion after a storm, and it is native to rivers and lakes. Hydra was named after the monster of Greek mythology that according to legend lived in the swamps of Lerna on the coast of the Peloponnese peninsula. Its snakelike tentacles with heads continued to grow back after they had been severed.

Not unlike its mythological namesake, the fresh water polyp Hydra is capable of replacing lost body parts. Researchers in Kiel have studied Hydra's special ability, and they have come across the transcription factor Forkhead box O (FOXO). The Methuselah gene FoxO arrests the aging process of the cell; it bestows the cell with the ability to divide more often, and over a longer period of time. The stem cells, which are more abundant in Hydra than specialized body cells, produce all the cell types that are required for de novo generation as well as regeneration of individual body parts. These stem cells thus enable the continuous regeneration of the body of the delicate fresh water polyp. Scientists have discovered particularly active FOXO in centenarians.

Genetics, however, determine only about 20 percent of our life expectancy, while the environment is responsible for the vast majority of influences which ultimately govern our life span. Does this mean more rosemary, anchovies and exercise? Scientist Alan Maisel is convinced: "I believe that it will be very much worth it for all who want to live a longer life." ■

INFOBOX

Finding a happy medium

For the past 40 years, Swedish physician Bertil Marklund has contemplated the question of how one can prolong one's own life. His formula for happiness: "Live according to the Lagom principle. Lagom decribes the medium between "too much" and "too little" and thus discourages any type of excess or exaggeration. Dr. Marklund, isn't this boring? "The Italians and the Canadians are asking me the same question. They have a hard time with the concept of Lagom! But it's not about restrictions. According to Lagom, it's fine to cross the line from time to time and eat junk food or drink too much juice. The most important goal is to find a balance in daily life. On the other hand, if someone truly finds that everything has become too boring, depression may be looming, which, of course, is not healthy at all", says Marklund.

A Quantum Leap

The quantum computer is supposed to be able to break any given code, process massive amounts of data and solve complex problems. Development, however, is still in its infancy.

The quantum computer is a marvel of efficiency. Its strengths are showcased by the example of one logistics firm searching for an optimum delivery route – as this seemingly simple question poses a substantial challenge for today's computers. The computer calculates all routes in sequence and subsequently compares the results. Only four cities to be visited on a single trip will result in 24 possibilities, costing computing power – and time. The hour of the quantum computer has arrived. It is capable of performing all computation steps simultaneously and thus recognizes the perfect route in an instant.

Here and there at the same time

The secret of the quantum computer: it complies with the laws of quantum mechanics. A classic computer stores information in the form of bits. These can assume only one of two possible states, either 1 or 0. The basic unit of the quantum computer, the quantum bit (qubit), on the other hand, is capable of assuming both values simultaneously. "Physicists are speaking of an overlap, or superposition, of the two states", explains Kristel Michielsen of the Jülich Supercomputing Centre as she utilizes a simple table top fan with two blades to clarify. A classic bit can be represented by the fan at rest – both blades, for example, point up and down. The qubit, however, resembles a fan that rotates at such high speed that one can no longer distinguish the blades as they appear to point in all directions simultaneously.

Since the quantum computer performs its calculations using an overlap of all possible values, it is capable of completing numerous mathematical operations at the same time, which, if performed by binary computers, would have to be carried out in sequence. In this way, it solves certain problems considerably faster than its digital colleagues. The more qubits are used, the more operations the computer is capable of performing simultaneously.

Competition for the best qubits

The optimal architecture of the qubits has been the subject of intense pursuit by scientists worldwide since the 1990s. Some researchers work with chains of stored ions while others bank on cesium ions or synthetic supra-conductors. At this time, quantum computers function only in a laboratory setting as they are extremely sensitive to environmental factors; for example, some only work at a temperature of minus 273 degrees Celsius. Nevertheless, large firms and organizations are investing significant sums of money in the research of the miracle computer. IBM®, Google®, Microsoft® – even the US secret service NSA, NASA® and public research institutions – are working fervently on this technology.

> *"We do not expect that at some point in time everyone will have a quantum computer in their home."*

In March, during the annual meeting of the American Physical Society® in Los Angeles, John Martinis and his team from the University of California® at Santa Barbara introduced their quantum processor named Bristlecone, which had been developed for Google. It is said to reach 72 qubits, thus able to solve difficult optimization problems, as well as deliver new knowledge in the field of artificial intelligence, the scientists post on their Google blog. The record thus far was close to 50 qubits, whereas 20 are considered the minimum for a functioning quantum computer.

What is it, though, that companies expect from the quantum computer? Google, for instance, intends to use quantum technology to train artificial intelligence. Other firms expect future areas of application to include the development of new drugs, logistics and finance. Even complicated simulations such as those surrounding the big bang or climate models are thought to be possible. Car makers hope for precise predictions of traffic flow in order to recognize and thus prevent congestion.

The fear of cracking the code

Hope and fear – depending on one's perspective – rest on encryption and decoding of data. The quantum computer would be capable of breaking any code based on prime numbers in a heartbeat – computations that would take current computers years to perform. The other side of the coin would encompass the development of a novel quantum cryptography that would increase data encryption security. Scientists, including Professor Wolfgang Schleich of Ulm University, doubt that the quantum computer will conquer the world in the same way that the binary computer did. "We do not expect that at some point in time everyone will have a quantum computer in their home", forecasts the head of the Institute for Quantum Physics. To err is human: in the past, if anyone had predicted that one day almost everyone would own their own computer, that person would most likely have been declared insane. ■

Invisible computing power
The most powerful quantum computer achieves 72 qubits – which renders it capable of solving the most complex optimization tasks while delivering new knowledge on the topic of artificial intelligence

Exploring Life

Respect Your Food!

Crooked carrots, brown bananas, expired pasta – every day, edible foods end up in the garbage instead of on the plate. Food waste is a global problem – and a question of values.

Since March 2018, Italian star chef Massimo Bottura has been serving fine foods in the "Refettorio Paris", located in the crypt of the church of La Madeleine, in Paris's 8th Arrondissement. Every evening, 100 meals are served to local people in need. The menu is prepared from food donations that originate, for example, in the large supermarkets, such as the Carrefour. These are fresh, palatable foods that, due to either optical flaws or expired sell-by dates, can no longer be sold in shops.

In contrast to German supermarkets, retailers in France are required by law to donate so-called superfluous foods. Approximately 130 kilograms of food, destined for the landfill, are used by Bottura and his team every night. In his battle against food waste, and to further social inclusion, the chef founded his non-profit organization "Food for Soul" in 2015. His Refettorios are now represented in Milan, Rio de Janeiro, London and Paris.

Global problem, far-reaching consequences

According to the study "Global Food Losses and Food Waste", conducted by the Save Food initiative, the waste of food is a global problem with far-reaching consequences, as food waste contributes substantially to the loss of resources such as water. Since food waste also produces greenhouse gas emissions, it is thus directly linked to global warming. Each year, roughly 1.3 billion tons of food are either wasted or lost worldwide. According to reports by the Food and Agriculture Organization (FAO), approximately 222 million tons end up in the garbage in Europe and North America alone – almost the same amount of food that is produced in the countries of the sub-Sahara.

What a waste!
1.3 billion tons of food end up in the garbage worldwide every year

Simone Pott of World Hunger Aid says: "Across the world, 815 million people are suffering from hunger, while at the same time, a third of all food produced is lost during production or transport, or it rots in warehouses. Some of these losses are preventable."

The sustainability goal 12.3 of the United Nations provides that global food waste per capita on the retail and consumer level be reduced by half and that food waste occurring at the production level and during delivery be reduced.

Important research

The EU research project "Resource Efficient Food and Drink for the Entire Supply Chain", ReFresh for short, follows the same goal. 26 cooperation partners from 12 European countries and China work on new approaches to prevent loss by utilizing food that would otherwise be discarded – across the entire value-added chain. "We see that engaged players from industry, business, organized civil society and research, with support from the legislature, can together make a difference", says Nora Brüggemann of the Collaborating Centre on Sustainable Consumption and Production. She coordinates ReFresh project work in Germany. She is pleased that numerous activities are being initiated in companies as well as during interactions with consumers. "There is not one specific measure that is capable of instantly and drastically reducing food loss and waste in a single step."

The Swedish app "Karma" (karma.life) represents one approach against food waste. In 40 Swedish cities, as well as in London, it connects hungry customers with restaurants, cafes and grocery stores that offer superfluous foods at half price. Within the scope of ReFresh, issues such as customer communication on the value of food become topics of open discussion. Brüggemann says: "Our goal is to increase appreciation for food – on the economic and ecologic as well as on the moral level. Players within the supply chain must realize that production and consumption of food use valuable resources."

Successful education

Most consumers are not aware that the sell-by date has nothing to do with the expiration date of food, but that it is merely a guarantee for product quality, pre-determined by the manufacturer. Michael Schieferstein, food expert and founder of the organization "Foodfighters", which mainly relies on education on the topic of food waste, says: "With many products such as pasta or flour, a sell-by date is unnecessary. For the purpose of increased transparency, the sell-by date should be determined by the legislature, not by business."

A study conducted by the German Ministry for Food, Agriculture and Consumer Protection shows: 84 percent of food in German households is discarded based on an expired sell-by date. Other European countries display a higher level of appreciation for food. Within a mere five years, Denmark was able to reduce food waste by 25 percent. This success can be largely attributed to activist Selina Juul. In 2008, she founded "Stop Spild Af Mad" (Stop Wasting Food). During the course of her work, Juul develops educational programs for schools, and she relies on consumer power. Consumers, in her opinion, can achieve great results simply by cooking with leftover foods. She convinced Danish grocery chains to advertise, rather than discard, products with expired sell-by dates.

Two years ago, the store WeFood® opened in Copenhagen. Here, foods are sold which had previously been rejected by other supermarkets, import firms and local companies. For 30 to 50 percent of the original price. A win-win situation for all concerned and a valuable contribution in the fight against food waste. ■

! DIGITAL SAVIORS OF FOOD:

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etepetete-bio.de

imperfectproduce.com

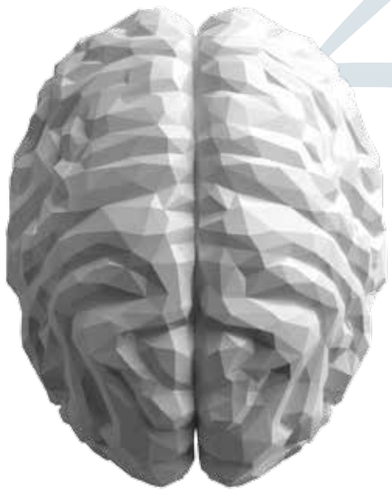
Scientific Myths

Science generally fulfills the notion that it will refute myths and legends by either logical or experimental means. However, even among scientists, certain fallacies are slow to die out…

1 No Cancer in Sharks

Cartilage suppresses de novo formation of blood vessels – one of the prerequisites for the development of tumors. This was the conclusion drawn by Harvard University® researchers Henry Brem and Judah Folkman in the 1970s. Quickly thereafter, the hypothesis emerged that cartilaginous fish such as sharks are immune to developing tumors. The book "Sharks Don't Get Cancer" by William Lane and Linda Comac thus opened up the commercial hunt for sharks in the 1990s; preparations containing shark cartilage powder fed the hope for an effective cure. Only in 2004, researchers at the University of Hawaii® disproved the assumption as they discovered that sharks very well do get cancer. While tumors are in fact a rare occurrence in sharks, and while the reason for this is still the subject of intense study, the belief that shark cartilage powder will help against cancer has finally been relegated to the realm of myth.

2 The Partially Dormant Brain



According to neurologist Barry Gordon of Johns Hopkins School of Medicine, we do not use a mere ten percent of our brains as is frequently stated, but in fact we use every part of it – almost continuously. This statement is supported by MRI and PET studies which, similar to biochemical methods, do not detect any inactive regions within our brains. Another myth – the separation into left and right thinkers, is based on experiments conducted on epilepsy patients in the 1960s. The physician Roger W. Sperry cut the neuronal connection between the brain hemispheres, which alleviated the epileptic suffering of his patients. At the same time, however, these patients displayed cognitive peculiarities that could only be ascribed to one hemisphere. Even though a number of studies show that brain functions are best stratified in a horizontal fashion, the idea that rational thought is located in the left hemisphere, while creativity is situated in the right hemisphere, is still popular.

3 The Sun Will Fade

When a star in the sky perishes, on occasion, the following occurs: it explodes in a supernova, and leaves behind its colorful remains as well as a neutron star, or a black hole. More lightweight stars of lesser mass tend to disappear with much less of a spectacle. Since it is considered a lightweight star, this theory was also applied to our sun – until recently. Simulations using a novel astrophysical model now show that the sun's mass is sufficient to leave behind a weakly glowing ring of gas and dust when it perishes – in roughly ten billion years. During this event, a part of its body will be hurled into space. The heat and radiation emanating from the remains will heat and ionize the shell, resulting in a planetary fog that will be visible for approximately 10,000 years. Thanks to this model, the lower limit of the mass that will not result in a glowing fog has now been adjusted.

4 The Primitive Neanderthal

Was the Neanderthal really a rather simple fellow, barely capable of speech and devoid of artistic expression? Now, cave paintings discovered in Andalusia paint an entirely different picture. These wall images had been attributed to our ancestors for decades. Latest investigations conducted by a team headed by the archaeologist Dr. Gerd-Christian Weniger, using the uranium-titanium method, have dated the origin of the art even farther back into the past than previously assumed. The wall art is roughly 60,000 years old – whereas Homo sapiens reached the Iberian Peninsula a mere 40,000 years ago. These findings substantially challenge the image of the primitive Neanderthal. Additional research is expected to unlock the origins of speech and the development of human cognition and intellectual power.

The Many Stars of Dubai

Off into the desert on a camel safari and a visit with the Bedouins – or do you prefer shopping, relaxing and a ballgame on the beach? The Emirate of Dubai offers entertainment alongside contemplation. Many of the amusements are as unusual as they are unknown.

City of contrast
The beaches of Dubai – and more – will meld all your expectations, impressions and experiences into one

He who knows himself and others cannot fail to recognize that the Orient and the Occident are no longer separate." The poet Goethe summoned the inseparable connection between the Eastern and the Western worlds in his anthology of poems "West-Eastern Divan". What would the universal scholar say today if he were to travel to the Orient? If he came to Dubai, he would be able to admire the meeting of East and West, of Orient and Occident, with his own eyes. On a small stretch of land along the Red Sea, which until recently was the untouched home of the Bedouins, wealth accumulated within mere decades is on display.

Oil, the "black gold", has catapulted Dubai, one of the seven states comprising the United Arab Emirates, into the modern age. But it is slowly running dry: only a few percent of Dubai's economic power still rely on it, as commerce and tourism have taken over as the predominant sources of income. In fact, tourists are entering the country by the millions, with numbers increasing every year; in 2020, the year that Dubai will host Expo 2020, 20 million are expected to visit the desert city.

Hospitality with tradition

Our breath is taken away as our plane descends over the island landscape raised from the sea. The project was considered megalomaniacal – only to prove what a combination of power and money can achieve. The islands represent only one of the new landmarks of the Emirate – they are also the location of the world's tallest building, the Burj Khalifa®, which reaches 828 meters into the sky like an outstretched index finger and which hosts the Armani Hotel, decorated in the purist style of the Italian designer of luxury goods.

Travelers will find more comfort than in most other places anywhere in the world; for example, in the Burj al Arab®, with its sail-shaped silhouette that rises up be- ►

hind the sandy beach and which is considered one of the best hotels in the world. We, too, delight in a bit of luxury in our Hotel Royal Mirage – while not decorated with seven stars, if offers a class of sublime service that is hard to find in Europe. In Dubai, luxury is enjoyed and also flaunted, and we find ourselves immersed in the tradition of Oriental hospitality.

Impressive culinary diversity

Only 15 percent of the close to three million inhabitants of Dubai are locals; the majority constitutes a mix of peoples from the four corners of the globe. They have come here as laborers to build, for example, the up to 16-lane freeways, or as merchants who conduct their business in the gigantic shopping malls or in one of the countless restaurants. The culinary diversity is impressive. Whether you visit a French gourmet restaurant, an Indian snack stall in Dubai Creek, the Old Town, or one of the hip beach eateries – the communal meal is a central component of Arabic culture. By chance, we catch a glimmer of the indigenous life in Dubai as, while meandering among the shadows of the high rises, we happen upon a small market where perhaps 50 farmers offer fruits and vegetables. Onwards to the spice market, where we will meet up with Tobias, an account manager from Hamburg, who is on vacation in Dubai for the second time. The scents and colors of the spices are overwhelming as we sample everything, and Tobias is excited to find unique souvenirs.

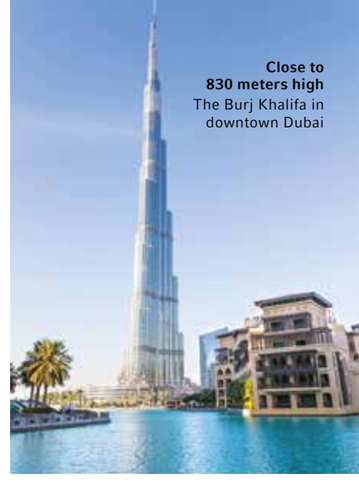
Mix of Orient and Occident

He spent the previous day sandboarding in the desert, a trip involving a jeep and a camel. "Over and over again, to the top of the dune, then down on the board. There was water from the cooler – it was superhot", says the 34-year-old. The busy beach, on the other hand, offers refreshment. Here, too, the mix of Orient and Occident is palpable; veiled women and men in black and white garments stroll next to bikini-clad beauties. Standup paddlers, kite surfers and bathers enjoy themselves on and in the clear water.

It is already getting dark. We decide to conclude the day by catching a show at the Theater La Perle, a theater that was built specifically for events in Al Habtoor City. Actors, acrobats, contortionists – the artists present a spectacle on the topic "Ocean" – it could easily compete with anything that you will find in Las Vegas. Those who would prefer to learn more about the old Dubai will have to leave the city and venture into the desert. Bedouins, as well as rich merchants, cultivate the ancient tradition of falconry. Their valuable animals are considered part of the family. Tethered by a long string of leather, the proud owner hurls pieces of meat into the air while the falcon catches them, learning to hunt through practice.

During the evening meal under the sky, the stars sparkle with a splendor that Europeans hardly ever have the privilege to witness. We eat in traditional fashion, with our fingers; our hosts serve delicious vegetables and crispy Falafel. Saying goodbye is not easy, even if instead of a Bedouin tent a comfortable hotel bed awaits us. ■

Out into the desert
Experience traditional falconry outside the city



Close to 830 meters high
The Burj Khalifa in downtown Dubai

Artfully arranged
Luxury destination: The Palm Jumeirah

DUBAI - CENTER FOR LIFESCIENCE EXCIBITIONS

MEDLAB, which is held annually in Dubai, is one of the largest laboratory and IVD exhibition & conference worldwide. Between February 4 and 7, 2019, Eppendorf will welcome you in hall 6, booth number Z6.G44. From Liquid Handling, to Sample Handling and Cell Handling products, Eppendorf will create a world of experience for all visitors.
Shortly thereafter, from March 12 to 14, 2019, follows the **ArabLab**, also held in Dubai. It is the most important exhibition of the year for the global laboratory and analytics industry. On this occasion, Eppendorf will not only display its laboratory solutions, but also will demonstrate that it is firmly rooted in the analytics industry.

EPPENDORF IN DUBAI

In 2006 Eppendorf established a subsidiary in Dubai in order to better support its customers in the entire Middle East. Recently, Eppendorf moved into its new premises at the Dubai Science Park. This is the BioTech Area focused on industrial and R&D manufacturing. It is the seat of many other international Life Sciences companies and laboratories, among them BioRad® and Olympus®. The unique proposition: Eppendorf is the first premium manufacturer with its own specially equipped calibration laboratory for pipettes, located directly in Dubai, offering premium services for its customers from the Emirates – a service that in the future will also include neighboring countries.

www.eppendorf.ae

LET'S GO!

The Emirate of Dubai grants its visitors a glimpse of its diversity.

ART & CULTURE

On Alserkal Avenue in Dubai's ancient art quarter "Al Quoz", galleries invite you to a vernissage, boutiques welcome browsing and a small theater is open around the clock. The award-winning building of the Etihad Museum with its white curved roof, on the other hand, symbolizes the 45 year anniversary of the founding of the United Arab Emirates.

https://bit.ly/2MOpgXO *https://bit.ly/2lp7vlf*

NATURE & ACTION

In the Dubai Desert Conservation Reserve, the first nature reserve of the UAE, visitors have the opportunity to observe Oryx antelopes and gazelles, among other animals. Many animals that inhabit the park had been close to extinction, and populations are allowed to recover here. The DDCR has now been added to the UN list of sanctuaries.

Only one hour drive from Dubai City, hiking and mountain biking trails are gently integrated into the mountainous countryside of Hatta. The barren landscape of the Al Hajar mountain range offers the ideal surroundings for adventurers.

www.ddcr.org *https://bit.ly/2lp8oKB*

CULINARY ARTS & TRENDY SPOTS

Whether French or Italian gourmet restaurant or a simple falafel stand: those who want to gain insight into the life of the young, international elite as well as that of the creative types living in Dubai should visit some of the trendy spots, such as the Tom & Serg®. Under no circumstances should one miss an Oriental evening in one of the smaller restaurants, for example, the hip Palestinian restaurant Zaroob in the Financial District.

http://tomandserg.com *http://www.zaroob.com*

Lab Lifestyle

Fighting Eppis®

What do you do when your incubation time is long and you are tired of waiting? We have an idea: why not construct fun animals or little fighters from Eppendorf Tubes® and place them on the instrument during mixing. The link below is full of ideas. Send us your Eppi® warriors per video! Tip: Screw-cap tubes work better than those with a snap cap.

https://bit.ly/2P4Iw79

Win a Writing Set!

Participate in our contest, and you can win a small Eppendorf writing set, complete with the legendary Eppendorf pipette-pen, a pencil, writing block and practical post-it notes. Simply answer the following question and enter to win one of five sets:

What is the name of the new extra-quiet centrifuge by Eppendorf? Tip: take a peek at page 40!

Send us an e-mail to magazine@eppendorf.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

LOTTERY

Hairstyling in the Lab

Whether a man or woman: when working in the lab, long hair often gets in the way and hair ties or clips are not always on hand. Avoiding irritating hair is certainly important and, above all, it should not be let down and allowed to roam free in sensitive areas in the lab.

Creativity is of the essence when it comes to taming your magnificent head of hair. The following two tips can be applied any time:

Cut the cuff off your rubber glove and use it like a regular hair tie.

Alternatively, twist your hair into a bun and fasten it with an Eppendorf serological pipette. Voilà, the perfect style!

Citizen Science

What role does the single-celled zooplankton Rhizaria play within the transport of carbon from the ocean surface into its depths, and how do they influence climate change? This is the question that the PlanktonID team – consisting of scientists from the GEOMAR® Helmholtz Centre for Ocean Research and Christian Albrechts University, both located in Kiel, as well as the Observatoire Océanologique de Villefranche sur Mer, is attempting to solve. Using a special camera, the team of biologist Dr. Rainer Kiko took thousands of underwater photographs which have now been made available on the website in the context of a clever game: the goal is to match the correct plankton photos and thus contribute to the research project in a playful manner. Great fun, not only for scientists!

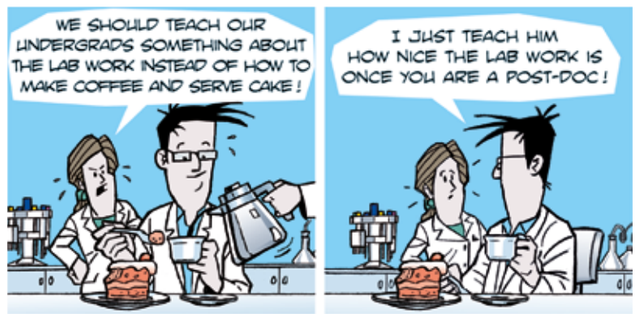
https://planktonid.geomar.de/en

Sure Thing

Powder residue of different hues, spilled liquids or simply dust: if a mobile phone or tablet stays in the lab, it will invariably become contaminated. Covers which are ideally not only dirt and waterproof, but which also protect from damage from falls, provide the only secure protection. Lifeproof offers nifty covers in different colors for iPhones® and iPads® that will withstand the demands of extreme sports. Ideal for active researchers!

www.lifeproof.eu

At the Bench



www.eppendorf.com/pipetting

Training and Self-Education

Training with Eppendorf
Seminars and webinars for work in the laboratory

How seminars and webinars improve your daily work and qualifications.

Training is mandatory to stay up to date with new techniques and developments in the working world. This especially applies to our sector: life science, research, and development. New methods are continuously arising and optimization of experiments and production processes is daily business. Employees must be focused on improving their knowledge and capabilities to grow within their company or research field. This assumes an open mind and a supervisor supporting training of each employee according to their individual position and career opportunities.

Employees can choose between many kinds of training. If travel is an option, you can visit a seminar in an institute, visit a conference covering several topics or a very specialized small group talk. Some companies offer trainings for groups at the customer site. Self-education without travel, such as online seminars and webinars, can also be an option and are often provided free of charge. Whatever training you choose, you need a training facility and provider you can trust. Someone with expertise and who has experience in giving trainings is a must. Ideally the training provides a certificate documenting the skills learned for your human resource department or for future job applications. Online trainings such as webinars mostly offer credit points. These credit points can be collected by attending webinars. Some companies require that their employees obtain a certain amount of points each year guaranteeing performance improvement in the company. With certificates and credit points, you have strong arguments when applying for a new job, a promotion or salary negotiations. Furthermore, your self-confidence and skills increase and you can be a role model for your colleagues.

Live or on demand
Webinars are available from many different providers. You can learn about the topics on offer or sign up to receive newsletters for topics you are interested in. Then, you can register for a webinar and either participate live or watch it at any time later "on demand". Thus, you have maximum flexibility and can fit your education around your work schedule. Additionally, you may watch the webinar as often as you like. Most webinars last one hour and offer a question and answer session at the end. Questions are answered live by the presenter or later via e-mail depending on the number of questions posed. Webinars are ideal to boost your knowledge in a short time for a very specific topic, such as viscous liquids, or pipetting in cell culture. Most webinars are hosted by life science companies such as Eppendorf, or research institutes. We offer webinars on various topics throughout the year, providing free, valuable information. Some popular topics are "Preventing Contamination in Cell Culture Labs" and "Aerosols – Spinning Hazardous Samples the Safe Way!".

Sharing knowledge and background
Classroom courses are another form of training. They give you the chance to immerse into a topic for one or several days and include hands-on sessions. The Eppendorf Training Center, located in Hamburg, Germany, has a great deal of experience in providing classroom courses. Each trainer has a scientific background and gives practical tips while teaching efficient workflows and sharing background information on their special field. Trainings and seminars are not only held in Germany, but all over the world, including on-site trainings adapted to your needs. The theoretical part is always supported by hands-on sessions in which the techniques can be practiced to give you confidence in applying them in your own lab. You will be able to improve your working processes. Eppendorf currently offers a full-day seminar on correct pipetting techniques, calibration and quality management. This course also provides information on pipette maintenance and how to do minor repairs on your pipette. Other seminars include a theoretical seminar on cell culture basics or a two-day training on cell-based assays. The practical part of the seminar takes place in a cell culture lab.

No matter which education style you choose, seminar, or webinar, you can be sure to receive a valuable training to support your daily work. ■

RETRIEVABLE EPPENDORF WEBINARS

Optimize your NGS library preparation with our epMotion® automated liquid handling system

Next-generation sequencing sample preparation is a labor-intensive process, which requires experience, precision, and accuracy to generate high-quality NGS libraries.

This webinar will enable you to understand the most common pain points with NGS library preparation and show you how to develop lab strategies that guarantee reproducible NGS results, and increase overall lab productivity.

Speakers: Dr. Tim Schommartz and Marc-Manuel Hahn, Application Specialists Liquid Handling, Eppendorf AG

Handling of viscous liquids – basics, techniques and tricks

Viscous liquids are a challenge in every lab that deals with them. Depending on how viscous a liquid is, pipetting is either impossible or it poses several problems that significantly reduce accuracy, precision and processing speed.

In this Webinar, you learn about the basics of viscosity, how to measure it, about different types of liquids and what influence viscosity has on your pipetting results. You also learn how to prevent problems with viscous liquids by using different pipetting techniques and appropriate instruments. Get some helpful tips and tricks and find out how you could even pipette honey.

Speaker: Dr. Hanae A. Henke, Global Marketing Manager Automation, Eppendorf AG

Everyday culture practice – improving reproducibility in cell culture

Eukaryotic cell cultures respond to the smallest of influences. Apart from the risk of contamination, minimal changes in cultivation parameters can affect the viability, growth and metabolism of the cells. In this educational webinar we will discuss Mycoplasma test methods, the effects of passage numbers and, the usage of FBS.

Speaker: Dr. Jessica Wagener, Application Specialist Cell Handling, Eppendorf AG

www.eppendorf.com/webinars

Relaxing Work

Annoyance from noise at the workplace is a problem in environments operating multiple instruments with varied noise levels and frequencies.

When a high level of concentration is required, noise above 55 dB(A) is considered annoying to most people. Noise pollution leads to stress, which can have a negative impact on the health and the well-being of employees. It can also negatively impact performance. Considering many scientists read, write and have detailed discussions at the bench, the accumulated noise level in the lab should be kept at a low level for a healthy, stress-free and productive work environment.

Noise in a laboratory comes from a variety of sources including hoods, biological safety cabinets, fridges, freezers and centrifuges. Noise from all sources adds up to an accumulated noise level. For example, two devices operating at 55 dB(A) produce a noise level of 58.1 dB(A). Adding a third device operating at 60 dB(A) leads to a noise level of 62.1 dB(A).

Centrifuges are one of the most frequently used instruments in scientific and diagnostic laboratories around the world. They can also be a source of noise pollution. Standard devices for up to 24 tubes of 1.5 or 2.0 mL are an integral component of many workflows including DNA/RNA extraction and protein purification. These centrifuges are continually in use and often sit on the laboratory bench right next to the users. State-of-the-art centrifuges specially designed for low noise operation help to reduce the overall noise level and contribute to a more enjoyable and productive working environment.

During the development of the new 24-place Centrifuge 5425, Eppendorf paid special attention on low noise emission. Short centrifuge runs of up to 12 minutes are whisper quiet at an average of 45 dB(A). This length of time is sufficient for the centrifugation steps required by most DNA/RNA extraction kits. Only during longer runs will the ventilator switch to full capacity to dissipate heat from the instrument – but even then, the Centrifuge 5425 remains the quietest microcentrifuge on the market with a noise level below 51 dB(A).

!

Accurate and Secure Pipetting of Highly Viscous Liquids

Pipetting and dispensing of viscous liquids presents us with a number of challenges including slow progress, inaccurate amounts aspirated and dispensed, as well as substantial sample loss due to residual liquid left behind in the tip. With the ViscoTip®, Eppendorf is now introducing a novel tip that has been developed specifically with multi-dispensers in mind and which is capable of dispensing highly viscous liquids with the utmost precision. Numerous tests have shown that liquids up to 14,000 mPa*s (comparable to liquid honey) can be successfully pipetted.

www.eppendorf.com/pipetting

Ready-to-use

Biological coating materials used for the expansion of stem cells are essentially non-defined growth surfaces that frequently reduce experimental reproducibility.

This dilemma is exacerbated by lot-to-lot variations between coating media, by the use of undefined growth factors and by extracellular matrix (ECM) components known to sustain cell adhesion and pluripotency. At the same time, the potential risk of pathogen contamination during preparation and storage cannot be ruled out. Therefore, in order to provide defined conditions, fully synthetic, animal component/human component-free culture systems are of great interest.

Eppendorf has now introduced a ready-to-use surface with synthetic fibronectin-derived motifs to support cell attachment by mimicking native ECM proteins. This novel surface enables long-term expansion of hiPSCs over 25 passages, and it is also suitable for hMSCs and other ECM-dependent cells. Furthermore, this surface allows expansion of stem cells in xeno-free and restrictive culture conditions, aiming to provide a completely defined culture system for PSCs without animal or human components.

Information about Eppendorf CCCadvanced® FN 1 motifs cell cultureware, including detailed expansion analyses of hiPSCs and hMSCs, is available at:

www.eppendorf.com/ccc-advanced

A Well-Designed Automation Software Offers Parameter Settings for Different Liquid Types

Some liquids such as viscous, volatile, or protein-rich liquids challenge liquid handling robots and automation systems. The software must enable adjustment of distinct parameters for various liquid types to obtain accurate and precise pipetting results. Ideally, optimized presettings for different liquid types, e.g. glycerol, alcohol 75%, or protein can be selected. Important parameters are the aspiration as well as dispensing speed.

For viscous and volatile liquids, a slower speed is recommended than for aqueous solutions. A so-called blow delay is important to delay the blowout and enable viscous liquids to flow down the tip completely. Accuracy and precision increase significantly with the correct blow delay and blowout speed. Furthermore, prewetting in two or three cycles is essential for accurate transfer of volatile liquids.

Another challenge is the cell culture medium which tends to foam due to the high protein content. Correct settings for this liquid type reduce foam formation and increase pipetting accuracy and precision. Beyond that, drops can easily attach to the outside of the pipette tip while aspirating or dispensing. A technique called “tip dipping” dips the tip into the liquid after the aspiration or dispensing to remove these drops on the outside of the tip.

If no proper settings can be found for a liquid that is hardly expelled, the last option is a mix function. The liquid is then dispensed into the prefilled tube and both liquids are mixed by up and down pipetting. epMotion® epBlue™ software allows all adjustment possibilities mentioned in this article.

Digitalization in the Lab

Digitalization and device networking are firmly established trends in nearly all businesses – but what does it stand for in our daily laboratory life? What does modern instrument and document management looks like?

VisioNize®
the Eppendorf connected lab system

eLABJOURNAL A BIO-ITECH PRODUCT

Workflow Management

An electronic lab notebook such as the eLABJournal® offers an intuitive and flexible solution to document and track research data. It improves efficiency when documenting, organizing, searching and archiving collected data. Documents or results can be shared and signed by authorized persons. The status of the workflow procedure is visualized. The combination of different products offers a platform that manages both workflows (SOPs, results, samples, stocks, etc.) and collaboration while enhancing productivity. That helps keep track of progress, organize collaborations and offers guidance in how to proceed with the workflow process.

VisioNize

Device Management

Connect your lab devices and monitor their status remotely with the Eppendorf VisioNize®- system. You can easily see where a free centrifuge is located or how much longer a PCR program will be running. This helps optimize the laboratory routine, plan the daily work more efficiently and to optimize the device workload. Important documents can be assigned directly to a device. Certificates, operating instructions, short videos, and much more can be managed centrally, thus eliminating long searches for important or up-to-date information. In addition, maintenance intervals for the devices can be managed by the VisioNize-system to enable efficient advance planning of downtimes.

eLABINVENTORY A BIO-ITECH PRODUCT

Sample Management

Do you always know where your sample is stored and what sample you have in your hand? Keep track of your samples with eLABInventory, a sample management tool that organizes any item in the laboratory inventory. Store samples in self-configured storage units such as freezers or refrigerators and efficiently track any sample in the lab. Easily browse through storage locations to store or locate samples in the lab. Centralize your entire lab inventory and keep your stocks up to date. Receive notifications when chemicals, samples, and consumables run out of stock. eLABInventory helps you manage all types of samples, specimens, and materials in the lab and thus increase lab efficiency.

DASware® control
Goes well with statistical analysis tools

Unlock the Box

Eppendorf partners with CAMO Software. Their integrated software tools help bioengineers to ensure product quality, reduce costs and speed up development.

In bioprocessing, products are manufactured using cells or microorganisms. Mankind has been using bioprocess techniques for ages for the production of food, like bread, beer, and yogurt. Nowadays, cells and microbes are also used to produce food additives, chemical building blocks, and biopharmaceuticals. Manufacturing of recombinantly expressed insulin is probably the most prominent example.

Smart tools to meet new challenges
Today, the demands on industrial bioprocesses are high. To be commercially viable, their development must be as efficient as possible, to bring new products to market quickly and manufacture them at a competitive price. In addition, of course strict quality criteria have to be met. To ensure quality and safety, regulatory agencies overseeing the biopharmaceutical industry foster the "Quality by Design" principle. According to this, drug quality should not only be tested for at the end of manufacturing, but the production process should be set up in such a way that quality criteria are met "by design".

Translating data to knowledge
The combination of different software tools can help in the development of bioprocesses meeting those demands. First, there is the bioprocess control software, with which critical process parameters, like pH, temperature, and oxygen concentration in the culture medium, can be monitored and controlled. Second, there are smart tools for experimental design. With a "Design of Experiments" (DoE) approach, researchers can set up experimental strategies to find out how critical process parameters influence product yield and quality attributes. Third, software tools for statistical analysis are needed. Multivariate analysis (MVA) is the method of choice to unravel complex interdependencies between variables, which are common in bioprocesses. The overall goal of experimental design, process monitoring and control, and statistical analysis is gaining a comprehensive understanding of how process parameters and product yield and quality are related. In the end, ideally, this allows full control: Monitoring the process in real time and taking action in case aberrations from the target state occur.

Bioprocess monitoring and control and statistical data analysis go hand in hand, but are traditionally done with different software tools. To close this gap, Eppendorf teamed up with CAMO®, a leading supplier of software solutions for statistical analysis. The result is a seamless connection between the Eppendorf bioprocess control software DASware® control and the CAMO suite of products for MVA and Design of Experiments. This automates the transfer of data between the software packages. Like this the researcher can benefit from the combined capabilities of the software tools, without having to worry about the underlying data infrastructure. ■

www.eppendorf.com/MVA

My Lessons in Mentorship

When I started formally mentoring undergraduate and graduate students almost 2 years ago, I was excited about the opportunity to help young scientists grow, but I was also nervous about the responsibility. As a postdoc, I was teaching a class in which students could conduct independent research projects under my guidance, and I wanted to make sure that my students would have positive experiences and develop strong foundations for their careers.I needed to come up with a mentorship philosophy. My approach was to reflect on my own experiences, positive and negative, as a mentee. One of my early mentoring lessons came as I worked toward my master's degree. I hoped to attend conferences and publish, but I didn't communicate these goals to my adviser. This was partly because I had just immigrated to the United States from a Hindu culture, where people earn things through good deeds rather than by asking for them. I focused on my work, hoping that my adviser would notice my efforts and present opportunities to me. It didn't work out that way. Now, as a mentor myself, my first step is always to have conversations with my mentees to understand their goals.

A second lesson came from my PhD adviser, who always let me know that my family mattered as much as my career did. When my father underwent quadruple bypass surgery, for example, my adviser made it clear that I should take as much time as I needed before trying to be productive in the laboratory again. This was just one of many instances when he showed that he valued my personal life and emotional well-being, which strengthened our bond and enhanced our working relationship. His supportive attitude also made me care more about my research and encouraged me to work harder. I take this lesson forward with my mentees by showing them that I really care about them personally, not just about the progress of their work.

> *"As a mentor … someone else's hopes are at stake."*

The final element of my mentorship philosophy came recently, from my postdoctoral experience. I had been focused on my own goals – including getting pilot data for my independent research project, teaching, and mentoring – and I wasn't paying attention to my adviser's expectations for my work. When I noticed that my relationship with him was getting strained and that he was not fully on board with my career development plans, I set up a meeting for us to discuss our expectations and goals, and we developed a work plan that will allow both of us to achieve our objectives. Now, as a mentor, I make a point of establishing mutually beneficial common goals with my mentees and discussing the steps my students must take to fulfill those goals.

Implementing this philosophy can be challenging. It takes more time and effort for both parties than a more hands-off mentoring relationship would. But this is a long-term investment that will result in fruitful and rewarding relationships. The mentor needs to foster clear communication about goals and ensure that both parties value each other as individuals.

As a mentor, the onus is on me, because it is not always in a mentee's capability to know how to establish a productive relationship with their mentor. So, I invite my students to my house and feed them home-cooked meals to promote open communication and understand their goals and dreams. I want them to feel cared for, not just valued for their work.

As I gain experience, both as a mentee and as a mentor, I will continue to optimize my approach, remembering that someone else's hopes are at stake. Sometimes a mentor helps a mentee dream. Sometimes a mentor gives a mentee confidence to believe in their dreams. Sometimes a mentor helps a mentee fulfill their dream. I hope to use my mentorship philosophy to turn the dreams of many into realities. ■

Shikha Jain Goodwin is a postdoctoral researcher at the University of Minnesota and Minneapolis VA Medical Center. She thanks Rachel Johnson, Thomas Goodwin, and Udit Jain for their feedback. Send your career story to SciCareerEditor@aaas.org.

Science AAAS

INFOBOX

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Two Big Eyes

The jury at the competition "Photographer of the Year" agreed that this cute insect photo by Miao Yong was definitely worth a special mention.

Waiting for the right moment

"I was photographing insects in a park near home in Zhejiang province, China, when suddenly I found two damselflies in the grass. They kept flying and it was very difficult to focus on them; I could only wait patiently for over ten minutes until suddenly they parked behind a leaf, so I caught the funny moment." This is how photographer Miao Yong describes the conditions under which he succeeded in capturing this extraordinary image.

Patterns in nature

Supported by Eppendorf since 2012, this competition of the Royal Society of Biology invites photographers to submit their pictures and compete for the titles "Photographer of the Year" and "Young Photographer of the Year". The 2018 motto: "Patterns in Nature." It describes how life on Earth encompasses a myriad of regular shapes, sequences and structures. The contestants were encouraged to capture these details of biology.

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