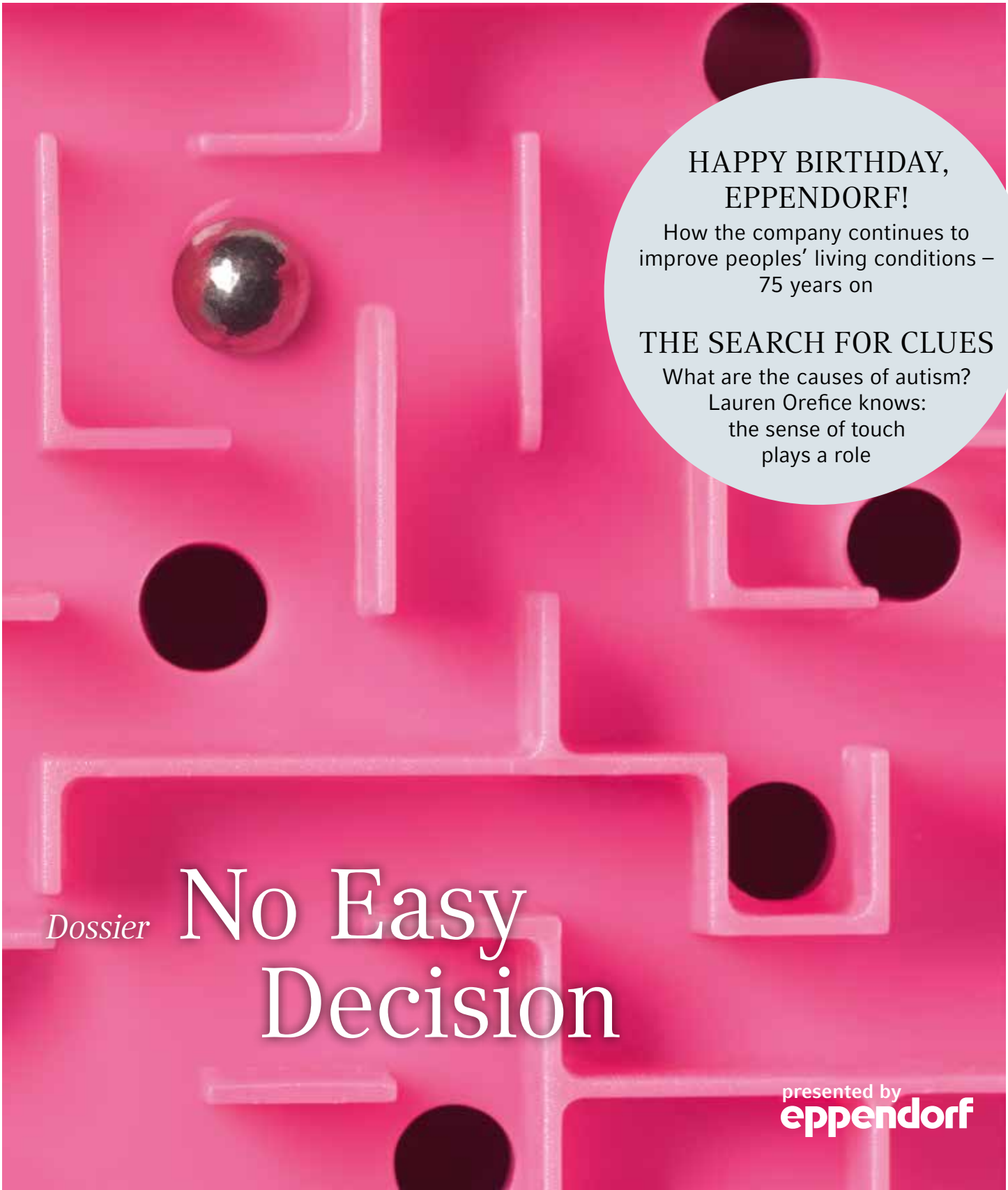
Off the BENCH

01
20

The Eppendorf – LifeScienceStyle Magazine



HAPPY BIRTHDAY, EPPENDORF!

How the company continues to improve peoples' living conditions – 75 years on

THE SEARCH FOR CLUES

What are the causes of autism? Lauren Orefice knows: the sense of touch plays a role

Dossier

No Easy Decision

presented by eppendorf

ISSN 2625-1116

SUBSCRIPTION AND FEEDBACK
You want to make sure that you will continue to receive future issues? Please visit the website **www.eppendorf.com/abo_OTB** and subscribe to "Off the Bench" for free.

We look forward to your feedback, which will tell us whether we have indeed achieved our goal with this issue. We invite you to submit your suggestions for improvement:

magazine@eppendorf.com

ISSN 2625-1116

Dear Reader,

When the founders of today's world market leader Eppendorf, Dr. Hans Hinz and Dr. Heinrich Netheler, started repairing defective laboratory instruments and developing new devices in 1945, they had a vision: to improve people's living conditions. Today – 75 years later – this founding idea is still Eppendorf's guiding principle for entrepreneurial decisions that are always aimed at shaping the future.

In pioneering work, Eppendorf developed products early on that made laboratory work much easier. Examples include the photometer from 1949 onwards, which is still in the portfolio today, and the Multipette® 4780, which was launched in 1978. This year, "Move It®" is a special highlight: with the multichannel pipettes, the tip distances can be varied and thus up to twelve samples can be transferred simultaneously.

Behind innovations like these there is always the following question, which we are dealing with particularly intensively in the anniversary year 2020: what will the science of tomorrow look like? Our thoughts on this and a selection of milestones from our history can be found in the "Inside Eppendorf" section on pages 26 to 27 and for further information at *www.eppendorf.com/75-years*, where our 75th anniversary is given special attention.

A certain development, whether entrepreneurial or personal, is always the sum of all our decisions. Whether they are right or wrong is often only known afterwards. But how do decision-making processes work? And what kind of power does artificial intelligence have when we feed it with information and let it make decisions for us based on algorithms? This is a complex topic that we examine from all sides in our dossier.

We hope you enjoy reading the magazine,

Eva van Pelt
Co-CEO

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

www.eppendorf.com/otb

Science News

From zero to a hundred
The cheetah is the master of the sprint – no other land animal in the world is as fast as it is

Unsurpassed

Meet the King of the Sprint: the cheetah. In as little as three seconds, it can reach a speed of more than 100 kilometers per hour and thus accelerate almost faster than a Porsche. On top of its extraordinary running style, it is its lean physique that allows the feline predator to perform at this top level. But the cheetah cannot keep up this pace for very long; after about 400 meters it is exhausted.

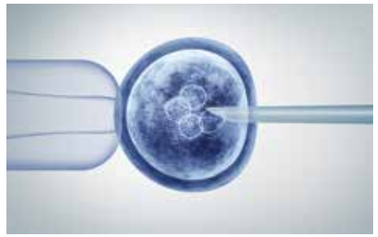
In stark contrast to the athletic cheetah, a 55 ton sperm whale may not impress with its speed, but it is instead one of the loudest animals in the world. Its clicking sounds reach a sound pressure level of 230 decibels. For the sake of comparison, a fighter jet at take-off emits a mere 140 decibels.

The water is home to even more champions within the animal kingdom; for example, the Greenland shark, with its life expectancy of 400 years. The only animal to surpass it in this way is the giant sponge *Anoxycalyx joubini*; it can reach the ripe old age of 10,000 years and it is thus the oldest living organism in the world. The secret to the longevity of these animals, presume scientists, is rooted in their particularly slow metabolism as well as in specific genetic features.

Record in Materials Science

In the race to produce the darkest material, two US scientists were able to outperform the previous record-holder, “Vantablack”. They have developed a surface capable of absorbing 99.99 percent of light. Like its predecessor, this particularly dark material is manufactured from carbon-based nanotubes in order to obtain a specific surface structure. A manufacturing process enabled even further improvement of the absorption capacity. While the naked eye is unable to detect the difference to Vantablack, which absorbs 99.96 percent of light, this new material is considered a significant step in the direction of the deepest black.

Goodbye Hereditary Disease?



Despite ongoing ethical discussions, the genome editing system CRISPR has long been accepted practice in international research. A team of scientists from the Broad Institute in Cambridge, USA, has now developed the method even further: in the case of prime editing, the DNA is no longer cut, but its components are precisely exchanged, deleted or altered – a method touted to carry a lower risk. Prime editing could one day enable the correction of 89 percent of all heritable human diseases.

39 Bits

per second – according to a study conducted by scientists at the University of Lyon in France, it is at this speed exactly that all 17 languages in the study transport information from mouth to ear. While Japanese and Spanish are considered to be fast-paced languages, they do not transport any more information.

Diagnosis Breakthrough

Using 27 laboratory values and heart rate, scientists have succeeded in diagnosing post-traumatic stress disorder (PTSD) in soldiers with an accuracy of 77 percent. Up to now, such disorders of the psyche can only be diagnosed via certain symptoms. Frank Doyle’s team from the John A. Paulson School of Engineering and Applied Sciences in Cambridge,USA divided soldiers who had suffered PTSD during war and soldiers without PTSD into two control groups for the experiment, in order to compare all available laboratory results. From the abnormalities, they selected the relevant comparative values for an accurate diagnosis.

Outstanding

There are approximately 65,000 known tree species worldwide, and some of them have made quite a name for themselves. They are higher, older or heavier than their peers – and they continue to amaze researchers and nature-lovers alike.

Biblical Age

969 years old – according to the Old Testament, this was the age reached by Methuselah. It is therefore not surprising that the oldest living tree in the world known today has been named after him: Methuselah, a specimen of the bristlecone pine, has been estimated to have thrived and survived in the White Mountains of California for approximately 4,850 years. The White Mountains, as well as Nevada and Utah, are home to the ancient tree species, many of which are several thousand years old. The secret behind their longevity: in contrast to the DNA of, for example, humans, which is subject to pre-programmed, natural deterioration, this particular pine has an extraordinary capacity for repairing and reproducing damaged cell material. Moreover, the tree has adapted: pests hardly ever infest its robust wood; the dry surrounding air protects it from rot, and the vast distances between individual trees prevent extensive fires.

Patience Rewarded

Not only one, but two records are held by the Seychelles palm tree, also known as the Seychelles nut: in addition to the largest flower and a cotyledon that measures four meters, this tree develops the largest and heaviest seeds in the plant world. The giant seeds weigh up to 18 kilograms, and up to three can be found inside a single ripe fruit. The ripening process, however, takes time: only after six to seven years does the fruit fall from the tree, and it takes another two years to germinate – maybe. The complicated reproductive behavior of the tree is the reason why its existence is limited to the Seychelles. The name of the fruit, "Coco de Mer", meaning "nut of the sea", originates from a misunderstanding; for the longest time, people believed that the seeds drifted across the ocean to spread the species; in fact, they simply sink. Today, this palm tree is listed as an endangered species.

Subterranean Secret

The trembling poplar, whose white trunks protrude from the Utah earth, holds a record that may not be immediately obvious: behind the modest surface, there exists what could possibly be the heaviest living being on earth. The network of roots of its 40,000 trunks is connected underground and thus forms a single organism that spans 43 hectares and would weigh six million kilograms. It is aptly named “Pando”, from the Latin for “to expand”. Ironically, wildfires have presumably enabled the vast expansion of the tree: fires destroyed the trunks, but never the root network, which subsequently sprouted anew on the surface. Without this survival mechanism, other trees, mainly conifers, would have competed with the tree, which is sensitive to the dark, for space and resources. Life as a poplar grove, however, is not entirely without danger: fire suppression by humans, as well as grazing of young trees by deer and cattle, have increasingly afflicted the record holder in recent years.

Like Father, like Son

Hard to ignite, resistant to pests and easy to work with: the coastal redwood, also known as *Sequoia sempervirens*, delivers perfect timber, which is why it has seen massive clearcuts since the 1850s. Today, you will find a mere ten percent of the original population in California’s national parks. Two particularly magnificent specimens live in Redwood National Park, the name of which may be traced back to the striking red wood of the giant Sequoia. Helios and Hyperion, named after the Greek sun god and his father, are considered the tallest trees on our planet. The slightly taller Hyperion measures an impressive 116 meters. How he manages to transport vital fluids to the top, against the force of gravity, remains a topic of debate among scientists. Most likely, though, this feat comes very close to the limits of what is biologically possible.

Live From the Lab

Students and researchers connected by video call: the online platform “Ring-a-Scientist” brings scientists into the classroom – to everyone’s benefit.

Science is not limited to the natural sciences”, says chemist Natasha Aristov. “I want to sensitize children to the idea that science does not always involve a white lab coat and a laboratory.” The 61-year-old works as an educator at Hector Children’s Academy in Stuttgart where she offers seminars to interested children and youth. One of her courses carries the title “Discussions with Scientists” – here, she gives an overview of the different fields within the sciences, and she provides opportunities for children to engage with the researchers.

> *“Ring-a-Scientist brings science to the classrooms – live via webcam.”*
>
> Kerstin Göpfrich

But how, as a student, does one talk to scientists? How do you find researchers who are willing to field questions and talk openly with students? You call them. “Ring-a-Scientist” is the name of the platform where scientists sign up to talk about their research. To date, ring-a-scientist.org comprises approximately 140 profiles from a broad range of faculties. Bonus: teachers use it to search for a contact who could enrich their courses with scientific knowhow. If they are successful in finding a good match, a video call will take place.

Boundless curiosity

Natasha Aristov’s students regularly talk with a total of seven different scientists – among them neurologists, biologists and physicists. Exchanges with economists, educators and linguists are equally important to her. This is how she met Aleksej Tikhonov who studies Slavic languages at Humboldt University in Berlin. During his dissertation, as part of a project funded by the Volkswagen Foundation, the 29-year-old, together with other graduate students, developed a tool that is meant to help match large numbers of manuscripts with the correct authors. During the video call, the students wanted to know everything: whether he would be able to work for the police; whether his ability to speak several languages was helpful; what it was like to write a doctoral thesis. “I was surprised how well the children were prepared and how much they already knew about my topic”, reports Tikhonov.

“The students’ reactions were overwhelmingly positive”, recounts Kerstin Göpfrich, Doctor of Biophysics, who, together with her physicist colleague Karl Gödel, created the platform. “On one occasion, a class called to find out how my research project had progressed, six months after the video call”, says the 30-year-old. She talks to classes approximately every other week, and she loves it. In line with her discipline, she offers insights into scientific research. Wearing a traditional lab coat, she demonstrates experiments before a webcam, or she guides the class through her laboratory at the Max Planck Institute for Medical Research in Heidelberg. At the same time, she offers a wealth of information on university programs and scientific careers.

Private engagement as a cornerstone

The allegation that science hides in its ivory tower is not new – and science communication has long been an independent field. At the same time, traditional classes are often criticized for their lack of practical instruction. “Ring-a-Scientist” hits two birds with one stone. Göpfrich puts it in a nutshell: “We bring science into the classroom, live via webcam“.

It all began with personal engagement; even as a student at university, the young researcher visited schools and talked about science and research. If the timing wasn’t good, or if the commute was too far, she would suggest a video call as an alternative – the idea for “Ring-a-Scientist” was born. Göpfrich and Gödel then applied for funding from the “Free Knowledge Fellows Program”, a project by the Stifterverband (Donor’s Association), the Volkswagen Foundation and Wikimedia Germany.

Learning from each other
Course participants from the Hector Children's Academy in Stuttgart in exchange with medical researcher Dr. Kerstin Göpfrich

With funding in hand, they created the website during the program year 2017/18, and the private project became a platform.

The funding laid the technical foundation – since then, only minor changes have been made. More was not necessary, says Göpfrich, the portal runs itself: “Teachers post a request, and the researchers can answer independently.” For her as a volunteer operator, the system creates very little work. Following initial contact, the subsequent communication is often conducted through other channels outside the platform. For this reason, the numbers of requests, as well as the numbers of video calls that actually take place, are difficult to measure, but it was important to her that the project be conducted openly – without tying the visitor to the website.

International expansion

Göpfrich envisions increased development potential by spreading the word about the portal among teaching staff – also at the international level. While the researchers now offer discussions in more than ten languages, most of the interaction is with German schools … for now. “I once had a video call with a class on the British Channel Island Jersey. Being able to expand on this would be a really nice success.“ ■

HOW “RING-A-SCIENTIST” WORKS

For teaching staff:
The profiles of all scientists can be accessed on the website. Search filters help to find the person who best fits the topic. Contact can be established immediately via the platform. Once an appointment has been found, nothing more stands in the way of a conferencing call.

For scientists:
Under “register and participate”, anyone who wants to participate in the platform may generate a profile – even while still attending university. Fill in the online form with your contact information, faculty and research focus. Upload a picture, and you are ready to go.

MORE ON THIS TOPIC:

Visit the website

ring-a-scientist.org

Can of Worms

We would like to introduce what may be the most ecologically beneficial animal on earth: the earthworm. 141 scientists from 57 countries have published the first world atlas of the worm. It uncovers surprising findings.

For its achievements in the area of ecological balance, it would well deserve the title "Worldworm". The English refer to this king of the earth as the earthworm, in German it is "Regenwurm" – for its active ("rege") behavior. The most widely known representatives include the dew worm and the compost worm; they are related to at least 7,000 species within the subclass of Oligochaeta.

For such a small organism, the earthworm, which is blind and deaf and which possesses neither spine nor limbs nor teeth, is capable of extraordinary feats. It lifts 60 times its body weight. The dew worm, at 30 centimeters, is one of the longest worms in its family, and it lives for up to six years. To make it clear from the start: it will only reach this ripe old age if it does not fall victim to a spade that will cut it in half. The belief that earthworms will survive such trauma is an urban myth. It is only possible under certain circumstances. More on that later.

Charles Darwin's book on worms

It begs the question: why did 141 researchers from 57 countries embark on creating a world atlas of worms and decide to publish it in the American scientific journal "Science®"? Well, even the father of evolutionary theory, Charles Darwin (1809 –1882), devoted an entire book to the earthworm in 1881 – his last. "The Formation of Vegetable Mould through the Action of Worms" ended up being almost as successful as his work on evolutionary theory. The British naturalist recognized the importance of the earthworm for the fertility of the soil. Many of his colleagues deemed him to be crazy; at the time, earthworms were considered a garden pest that would gnaw on plant roots. Today we know the more worms populate the soil, the higher the soil fertility.

To quote Darwin: "It may be doubted if there are any other animals which have played such an important part in the history of the world as these lowly organized creatures." More than 140 years later, worm scientists bemoan the fact that research into the exceptional role of the earthworm is still incomplete, and in October 2019, they wrote in "Science®": "Soil organisms, including earthworms, are a key component of terrestrial ecosystems. However, little is known about their diversity, their distribution and the threats affecting them."

Global research

In order to change that, scientists have compiled an atlas of earthworm societies from 6928 locations in 57 countries; they searched for patterns with respect to diversity, number and biomass of earthworms. A surprising discovery: "Climate variables were found to be more important in shaping earthworm communities than soil properties or habitat cover. These findings suggest that climate change may have serious implications for earthworm communities and for the functions they provide", write the researchers.

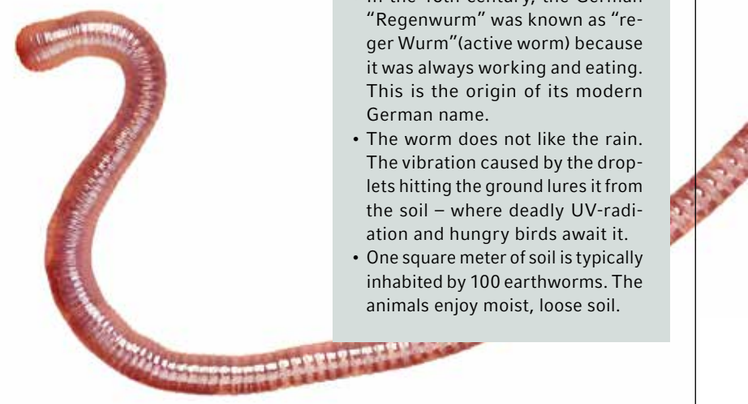
At the same time, the earthworm works comprehensively on preserving our ecological balance. This soil engineer not only breaks up the soil, it literally plows through the earth, loosens and aerates it and mixes mineral and organic substances. With its mouth-like front section, it attaches itself to a rotting leaf via suction and then transports the leaf underground – its tunnel, or living-tube, can reach up to two and a half meters deep and be up to 20 meters long. However, before the toothless worm can enjoy it, the leaf must be predigested by bacteria and fungi. Every day, the worm devours close to half its body weight in food, and during a single night, it pulls up to 20 leaves into its living-tube.

Waste disposal and delivery service

The earthworm simultaneously assumes the duties of waste disposal and delivery service. With its help, dead material is converted into nutrients. The digested remains, excreted by the worm on the surface at night, are of particular importance to the ecological balance: earthworm humus features a balanced nutrient ratio; its combination of enzymes, humic acids and minerals is unique. The resident microorganisms improve the soil in a substantial manner – this is why the purchase of earthworms is a common practice among gardeners.

Its tunnel systems also assist the penetration of rain water and increase the water-storing capacity of the soil. In this way, the earthworm effectively prevents floods. In addition, the tunnels facilitate the growth of plant roots into the deeper layers of the earth with their unique nutrients. Speaking of delivery service: for some animals, the earthworm is a yummy treat. Blackbirds and robins, for example, savor it.

And now for the earthworm myth. The belief that one earthworm, when cut in half, will give rise to two new worms is widely held. Not so: only the front portion, which includes the essential organs, continues to live – under the condition that the intestine is still long enough. In that case, the hind end may regrow. So – please be careful while gardening and avoid hitting a superworm! ■



SURPRISING FACTS

- Earthworms are hermaphrodites; each one of them possesses testes as well as ovaries. During mating, each partner acts as the male.
- Little powerhouses: earthworms can lift 50 to 60 times their own body weight, making them one of the strongest animals in the world in relation to their body size.
- While the earthworm burrows through the soil, it presses its short clawlike bristle pairs into the ground to prevent sliding.
- In the 16th century, the German "Regenwurm" was known as "reger Wurm"(active worm) because it was always working and eating. This is the origin of its modern German name.
- The worm does not like the rain. The vibration caused by the droplets hitting the ground lures it from the soil – where deadly UV-radiation and hungry birds await it.
- One square meter of soil is typically inhabited by 100 earthworms. The animals enjoy moist, loose soil.

Suitable counterpart
Scent receptors in organs can be activated by a specific scent – and thus have a considerable influence on the respective tissue cells

The Lock-and-Key-Principle

Hanns Hatt has dedicated his career to the sense of smell. His research paves the way to new diagnostic and therapeutic possibilities, based on the finding that the fragrance receptors are not limited to the nose.

Professor Hatt, what does spring smell like to you?
Hanns Hatt: This depends on where you live; which flowering plants grow in your vicinity and which foods are characteristic for the season. Europeans perceive a distinct spring fragrance that can be very different from the one in Asia or North America. For me, the scent of spring is determined by what emerges from the ice and snow: plants, mosses and decayed leaves – mainly earthy, damp, musty components of odor – paired with spring blossoms like violet, hyacinth or lilac. The warmer it gets, the more scent molecules are released into the air. This is why we experience spring with particular intensity.

Humans often perceive identical scents differently – why is that?
Hatt: The olfactory receptors in the nose, via nerve fibers leading through the bones of the skull, forge a direct connection to those centers in the brain that are home to memories and emotions: the hippocampus and the limbic system. Scents which we perceive repeatedly will always be interlinked with those lived emotions, images and sounds. The first experiences with a fragrance are likely very different from person to person, which is why we all judge fragrances differently.

How much is the human nose capable of detecting?
Hatt: You keep hearing this number of 10,000 fragrances which humans can distinguish. However, new research shows that this may be an understatement – the number is actually closer to several hundred thousand. In any case, our nose is better than we give it credit. Rather, the question is: how many fragrances are we able to name? We are not very good at it, although it is actually only a matter of practice. A perfumer may be able to identify one or two thousand fragrances more than untrained people – due to practice and experience.

> *“It is undisputed that we completely neglect the significance of smell.”*
>
> Prof. Hanns Hatt

Does this mean we underestimate the sense of smell?
Hatt: There is no doubt that we completely neglect the significance of smell and instead focus on images and sounds. At the same time, with every breath – approximately every two seconds – our brains are informed about the composition of fragrances in the air. The brain reacts, and as a result, our mood may change.

You say that we don’t just smell with our noses. What do you mean by that?
Hatt: More than 15 years of intensive research has shown that the 350 different fragrance receptors of the nose – the olfactory receptors which sit atop the olfactory cells and recognize fragrances – are in fact distributed across all cells throughout the body. This includes the liver, the intestinal tract, the heart and the skin, as well as sperm.

These receptors are able to smell?
Hatt: Not exactly; these receptors detect certain chemical substances which, if detected in the nose, are considered fragrances. Via the olfactory receptors on tissue cells, these chemical substances are capable of influencing, even controlling, cell function.

What is the current state of research?
Hatt: We know today that some of those olfactory receptors are tissue-specific, i.e. they only occur in the liver or in the gut, while others can be found throughout the body. The challenge is the exact fragrances which activate them are known for only 60 to 70 out of a total of 350 fragrance sensors. Therefore, we first need to find the key for each lock. Each receptor must be isolated individually and exposed to thousands of fragrances to see if it reacts to one among them. Only if I know the activator will I be able to see what the fragrance does to the cells. In the meantime, we have been successful in deciphering the cell function of a number of olfactory receptors for which the activating fragrance is known.

What have you learned?
Hatt: We were able to establish that scents are capable of influencing mainly the growth and the motility of the cells, but also their death. Moreover, they can induce the secretion of different substances, including neurotransmitters and hormones, by the cells. In summary, olfactory receptors have a large influence on tissue cells.

This sounds promising for the diagnosis and therapy of illnesses. Should we be hopeful?
Hatt: This knowledge feeds into a broad area of applications – from immunology to cardiology, and it applies to therapy as well as diagnostics. It is not only healthy cells that harbor fragrance receptors, but also diseased cells. We have studied approximately 15 different types of cancer, including breast and bladder cancer as well as gastrointestinal cancer. All these cancer cells harbor large numbers of certain fragrance receptors. It is possible that these cells produce these fragrance receptors either because they are mutated, or because it confers a biological advantage. For gastrointestinal, prostate and bladder cancer, among others, we were able to show that the fragrance sensors are capable of influencing the growth of the cells negatively. As a result, they grow less well, slower or not at all. Clinical trials have progressed the furthest on the topic of skin. For one receptor, we have identified the scent “Sandalore”, a type of sandalwood. It is capable of increasing the growth as well as the motility of skin cells, accelerating wound healing by 40 percent. It also increases the life span of a hair by 20 percent.

When will humanity benefit from this detective work?
Hatt: I am convinced that 20 years from now, people will take “olfactory receptor blockers” in the same way that they take beta blockers now. By that time, we will have identified the exact fragrances that will either activate or block olfactory receptors. The potential is incredible – right now, we are just seeing the tip of the iceberg. ■

SHORT PORTRAIT

German biologist, chemist and physician Hanns Hatt is a cell physiologist at the Faculty of Biology and Biotechnology at the Ruhr University in Bochum. For more than 40 years, he has been researching the topic of smell and fragrance perception, and he is internationally regarded as one of the most respected scientists in his field. It is his wish to bring his science closer to a broader public in a clear and understandable fashion. He is the author of two German bestsellers, which would translate to “Nobody Smells as Good as You” and “The Little Book of Smell and Taste.”
www.cphys.ruhr-uni-bochum.de

DOSSIER

Right or Wrong?

In times of unlimited options, we must decide – a thousand times a day. Our approach is not always entirely rational. Emotions tend to muscle their way in. Simple rules of thumb may help us make the better choice.

Leave nothing to chance
Make decisions consciously and skilfully, instead of giving up control

To bounce out of bed or to turn over one more time? As soon as the morning alarm goes off, the first decision needs to be made. Am I going to wear the sweater or a T-shirt? What's for breakfast – cereal or toast? Will I take the bus or the train? Even before the day has really started, we have made hundreds of decisions. Until we turn off the light at night, it amounts to roughly 35,000 decisions, write American neurologists Barbara Sahakian and Jamie Nicole LaBuzetta in their book "Bad Moves: How decision making goes wrong, and the ethics of smart drugs". We make some decisions quickly, based on gut feelings, whereas others give us a major headache. What is it that influences our decision-making, and how do we arrive at good results?

Until far into the 20th century, we were convinced humans make purely rational decisions. Prior to making important decisions, Benjamin Franklin, one of the founding fathers of the United States of America, was in the habit of listing all advantages and disadvantages. He then weighed the arguments on a scale of 1 to 10, according to importance and probability. Underneath each column, he drew a line, added up the scores – and the decision was made. In 1772, Franklin wrote in a letter to a scientist looking for advice that it was this technique which allowed him to reach the best conclusions.

The heart and the mind decide

Research by neurologist Antonio Damasio finally put the discussion to rest: the cool head alone is incapable of making any decision, and most models of rationality do not successfully reflect actual decision-making behavior. It was by pure chance that, in the 1980s, the head of the Department of Neurology at the University of Iowa discovered that emotions play a large part in the decision-making process. One of Damasio's patients who, after the removal of a brain tumor, had been rendered unable to feel emotions, was also left incapable of making any kind of decision. For hours, he would ponder whether to use the black pen or the blue one. According to Damasio's hypothesis, reasoning depends on our ability to feel. Latest research has shown that not only reasoning and emotions, but also prejudices and experiences, even hormones, the time of day or sales tricks influence our decisions.

Naturally, these turn out at times more, at times less astute. But what drives us to decisions that we later regret? A common mistake: we ask friends or members of our families for advice. "Our personal choices systematically differ from the choices we

60%

of decisions are made unconsciously even before you become aware of them.

make for others and from the advice we give to our friends", Psychologist Eva Krockow from the University of Leicester cautions. "Psychological studies found that people frequently encourage friends to take risks, which they themselves would typically shy away from", says Krockow. Many possible reasons exist: the "advisor" has more confidence in the friend who seeks advice than they have in themselves they want to encourage the friend in their personal opinion; or they simply misjudge the friend's situation. Krockow advises: "Being aware of differences in the decision-making for oneself and others is key to interpreting advice correctly and making more balanced decisions."

Lots of bad advice

In accordance with the "sunk cost effect", humans tend to hold on to decisions into which they have already invested time or money – even if they have already recognized that the choice is flawed. According to a new study, the fear of personal consequences in management leads to "CYA"-excuses; for example, the internal applicant is offered a promotion over a better qualified external applicant. In this way, the manager avoids conflict, but he ends up damaging the company. "Defensive decisions not only incur considerable additional cost, but they also impact innovation, leadership and customer satisfaction", says Gerd Gigerenzer, director of the Harding Center for Risk Literacy at the Max-Planck-Institute for Educational Research in Potsdam.

Freedom of choice as a challenge

On a daily basis, it is mainly too much choice that complicates our lives. Finding a partner on a dating platform? Choosing a movie from among thousands? Choice turns into torture very quickly. "People tend to want as many options as possible. Whether it's buying a car or a meal, they gravitate toward companies that offer more options versus fewer ones, because they believe a large selection will maximize their chances of finding the best fit", explains stress researcher Thomas Saltsman of the Social Psychophysiology Laboratory at New York State University. "When it comes to actually making a decision from all of these options, people can become paralyzed – and avoid making choices altogether", says Saltsman. And it can get worse.

81%

of the respondents in a study claim to rely on their brains when making important decisions.

Coke, Fanta® or water?
The enormous breadth of choice alone makes it difficult for many people to make decisions

35,000

Number of decisions every person makes each day.

"When they finally do come to a decision, they're more dissatisfied and regretful about whatever choice they make."

Now, what may help us make the best decisions in this sea of possibilities? Studies have shown that comprehensive information tends to confuse rather than help. For example, instead of comparing 500 toothbrushes prior to an online purchase, psychologists like Gigerenzer suggest simple "heuristics". These are rules of thumb that help us come to a quick and acceptable solution despite little time and limited knowledge. I could simply buy the toothbrush that I know. A different heuristic: I will only search until I find an acceptable – even if not the best – solution. I can also orient myself along the choices that my friends make. Or I make a decision based on my most important criterion. When booking a hotel, for example, I will only consider proximity to the train station and ignore everything else.

Sleeping on it overnight!

Today, science agrees on one thing: good decisions require heart as well as mind. Frequently, intuition corrects a seemingly sound and sensible decision – and vice versa. Those who aim to resist the ubiquitous temptations, for example while shopping, are best advised to trust not only their gut but also do their math. Stock market celebrity André Kostolany swore by the following strategy: he intensely studied an investment and then used his imagination to forecast performance and price development. And then he slept on important decisions for a night: "The evening is when you have the idea, the morning is for a critical stance, and by noon, the decision is made." ■

Autonomous systems
Critics complain that artificial intelligence has too much decision-making power

Mighty Machines

An autonomous car steers directly towards a pedestrian. How will the software inside the vehicle decide what to do? And who will be at fault in the case of an accident? This example shows that the use of artificial intelligence raises ethical and moral questions.

It translates text and sends us personalized ads; it determines our creditworthiness, drives us in our cars from A to B and diagnoses our illnesses. Artificial Intelligence (AI) is omnipresent in our everyday lives. Without our knowledge, and without us being aware, algorithms make daily decisions for, about, and against us.

How does Artificial Intelligence do it? It combs through massive data sets, recognizes patterns hidden therein and performs evaluations by weighing certain factors – for example, through large numbers of photographs of pets, linked to the labels "dog" or "cat", it learns to distinguish between these two animal species.

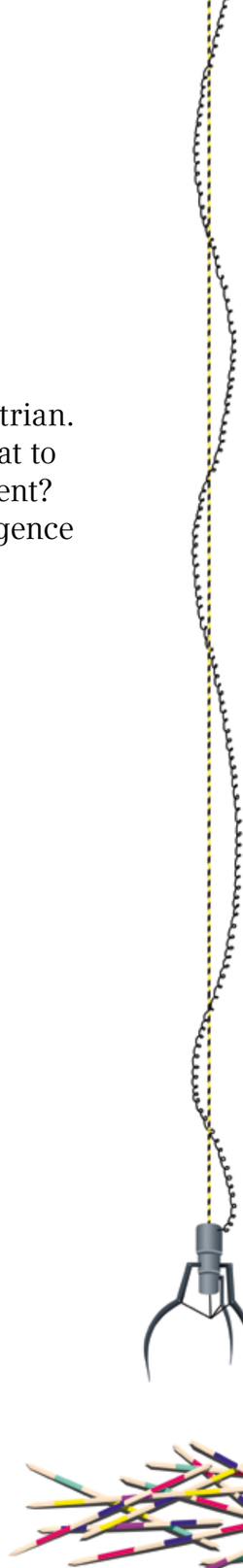
Autonomous vehicles and care robots

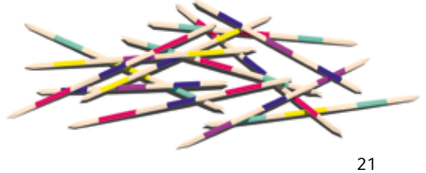
The list of areas of application gets longer by the day. Among these applications are autonomous driving, computer-assisted diagnostic systems and treatment and care robots in medicine. Even in the realm of international security, autonomous systems are making progress. For example, the EU is currently testing the automated border security system "iBorderCtrl". Using facial recognition and an online lie detector right at Europe's external borders, the system is said to be able to decide which persons are allowed to enter. Within the finance sector, automated trading systems independently buy and sell stocks and bonds, and university admissions are decided by algorithms.

Intelligent machines thus take over decisions that have so far been made by humans. Companies and organizations expect quick, objective, neutral – and hence fairer – decisions from AI than those that may be expected from supposedly prejudiced humans. "We often use irrelevant information or are influenced by extraneous factors. This is where machine intelligence can be helpful", says Karthik Kannan, Director of the Krenicki Center for Business Analytics & Machine Learning at Purdue University in West Lafayette in the US State of Indiana.

Do machines have morality?

That which sounds so promising raises ethical questions. When relying on autonomous systems, humans leave difficult moral decisions to a machine. Are autonomous systems really able to decide whether a person is credit-worthy or reliably estimate and predict the subsequent offense rates of convicted criminals? Science is deeply divided over the question whether algorithmic decision-making systems are capable of correct ethical "behavior" in complex situations.





Studies suggest that presumably objective algorithms – just like humans – are subject to prejudice. This effect is mainly due to distortions within the very database that is used to educate self-learning algorithms and which subsequently leads to misjudgments during the evaluation of individual cases and thus to discrimination.

AI suffers from prejudice

In this vein, a team led by psychologist Aylin Caliskan of the Center for Information Technology Policy at Princeton University discovered that AI adopts cultural stereo-types and prejudices from internet. For example, AI associated female first names primarily with family whereas male first names were associated with career. "Such biases may not be expressed explicitly, yet they can prove influential in behavior", write the authors in the journal "Science". A particularly horrific misjudgment had beset the automatic image recognition software by one software company: in one image, African Americans were classified as gorillas since the database for the category "human" was mainly populated with photographs of Caucasians.

If AI arrives at discriminating decisions based on such misjudgments, the consequences for those thus affected are especially tragic. While previously a bank clerk had to explain to their customer in person why their credit application was denied, they may now conveniently place the blame for the unpopular decision on the computer system. A reason for the negative decision will not be provided to the rejected applicant – as even the bank clerk may not be able to comprehend the decision-making criteria employed by AI.

> *AI adopts cultural stereotypes and prejudices from the Internet."*
>
> Research team from Princeton University

Transparent decisions

Under which circumstances are humans now ready to accept AI decisions? Scientists emphasize that these must be comprehensible and transparent. Ute Schmid, Professor of Applied Informatics at the University of Bamberg, Germany, agrees, citing the example of medical diagnostics. "Automated learning processes do help reach a diagnosis. If, however, these decisions do not make sense to the doctors or the patients, results must be viewed with caution and must therefore not be utilized further in safety-critical contexts such as medicine", says Schmid.

This is why science is exploring ways to render the decision processes within AI systems more transparent and comprehensible. For example, Informatics Professor Anupam Datta of Carnegie Mellon University in Pittsburgh has developed a method that allows traceability of the weighting of decision-making factors of AI – for example, by weighting the criterion "race" differently when granting credit and subsequently re-analyzing the new results. Researchers at the Centre for Cognitive Science at the Technical University in Darmstadt, Germany, have even attempted to program computer systems with moral decision-making behavior. To this end, they developed a "Moral Choice Machine" which is meant to equip AI with a moral compass. The researchers defined "good" and "evil" and then fed the AI with texts, the words of which AI was then tasked with sorting into the two categories. The scientists are convinced that AI is capable of making simple moral decisions based on these associations, even though it lacks human consciousness.

Humans in high demand

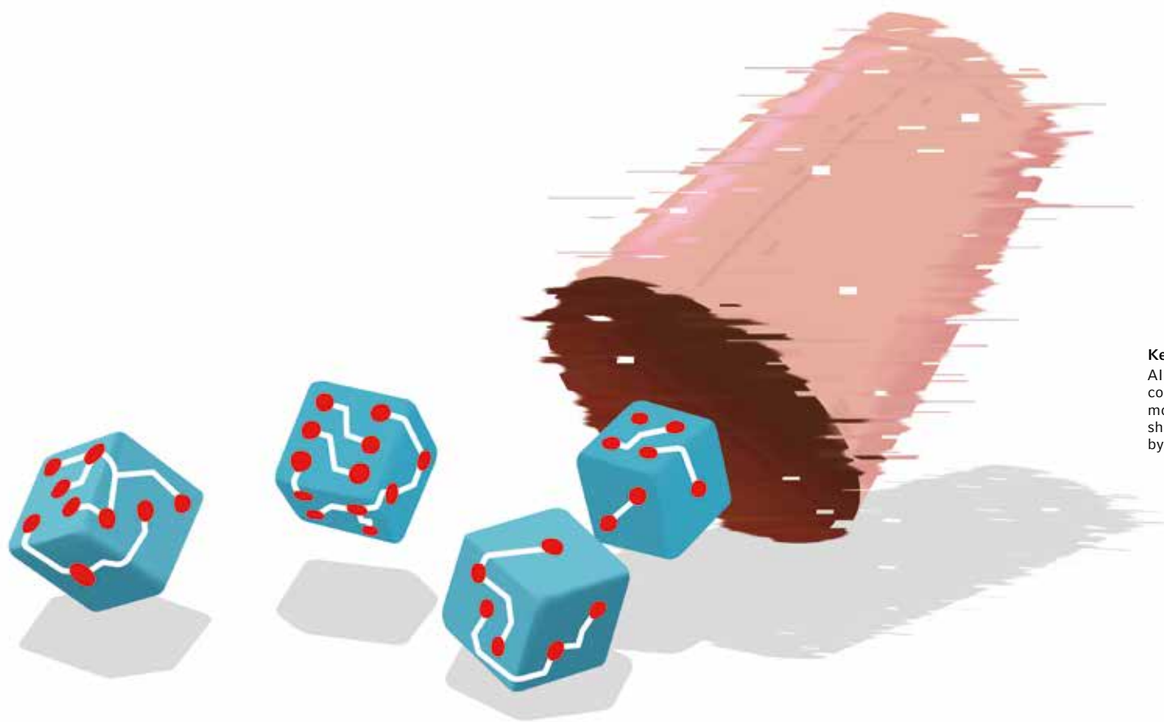
Meanwhile, critics caution against leaving complex moral decisions to machines. For example, the International Committee for Robot Arms Control (ICRAC) fights against the development and deployment of weapons which will make independent decisions about life and death. According to the group of researchers who work with Ute Schmid, human responsibility also continues to be in demand in the field of medicine. While AI may be able to arrive at a cancer diagnosis, it takes a doctor to evaluate the results and gently break the diagnosis to the patient.

Even in autonomous vehicles, it appears that a human cannot hide behind the software, reports Sydney Levine, scientist at the Media Lab at Massachusetts Institute of Technology (MIT), who led a study on the question of assigning guilt in cases of accidents involving autonomous cars. The authors discovered that in the case of an accident, participants tended to assign guilt to the person if the person and AI had been equally in control of the car. The reason for this, the scientists suspect, is that, according to our values, a vehicle controlled by AI is not an independent player that can act and decide freely. For these reasons, humans tend to absolve machines of any kind of guilt. ■

INFOBOX

Artificial intelligence

Computer systems that imitate human intelligence are called "artificial intelligence" (AI). Up to now, AI systems have been real specialists: they cannot comprehensively "think" like a human being, but help with the solution of individual concrete problems. For this purpose, AI often uses algorithms – a series of instructions formulated in computer language. AI can extend its capabilities by machine learning. Although artificial intelligence has now penetrated almost all areas of life, a study by the Bertelsmann Foundation shows that almost half of all Europeans do not know what algorithms are.
Three-quarters of European respondents would like to see more control in place over AI. Algorithmic decisions should be easier to understand, and there should be a right to have such decisions reviewed by a human being.

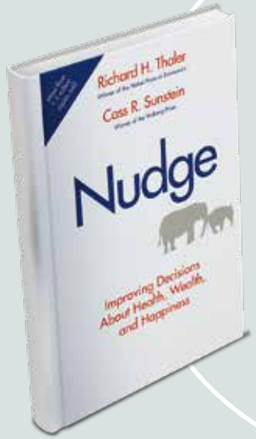


Keep control

AI makes decisions based on collected algorithms. However, morally difficult or vital conclusions should be tested and monitored by humans, experts demand

Learning to Decide

Even deciding what to read can turn out to be a difficult decision. Our book suggestions may help you make a selection.



Nudge

How to nudge smart decisions

Those who study nudges will not be able to get around this one: the standard work on the topic not only coined the term, but it opened the discussion surrounding the impulse behind decision-making processes and their political dimensions – it therefore deserves our unreserved recommendation.

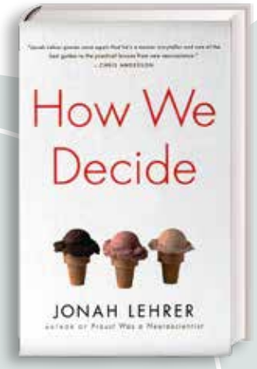
Richard H. Thaler, Cass R. Sunstein,
400 pages, Yale University Press,
approx. $25.00

Algorithms to Live By

The science of the perfect decision – from tidying up to dating

Selecting a university program; buying a car; marriage – decisions determine our lives. As individual as they may seem, predictable patterns often hide in plain sight – predictable enough that many decision-making processes may be simulated by algorithms. How theoretical informatics may be easily applied to everyday decisions.

Brian Christian, Tom Griffiths,
400 pages, Henry Holt and Co., approx. $20.00



How we Decide

The successful interplay between head and gut

Gut feeling or reason: there are rational decisions as well as emotional ones. But are these two mutually exclusive? By including neurological findings, Jonah Lehrer blurs the boundaries between reason and emotion and shows that it is the combination that often leads to the best decisions – and how to adopt the approach.

Jonah Lehrer, 368 pages,
Houghton Mifflin Co., approx. $18.00

INSIDE Eppendorf

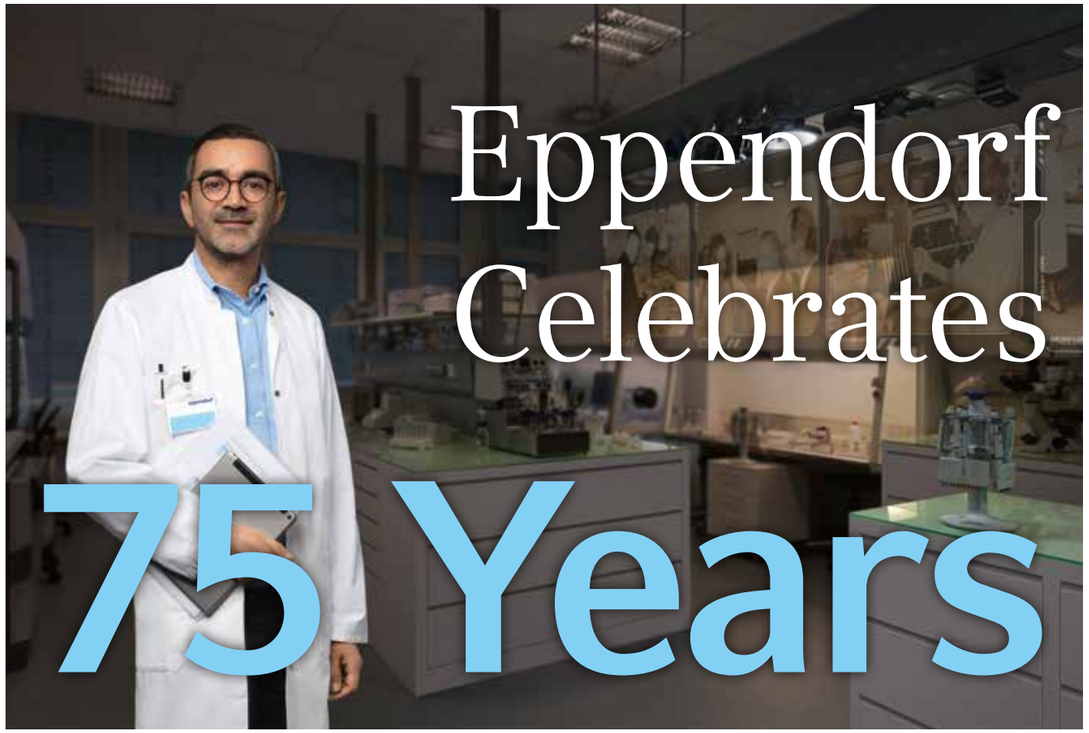
A look back at the past, a look into the future, product innovations from the here and now at Eppendorf – and there's something to be gained too!

SUCCESS STORY

Eppendorf is 75! About the milestones and the burning questions of the future

AUTHENTIC INTERIOR VIEW

What challenges scientists see in their laboratory work



Eppendorf Celebrates 75 Years

This year the Eppendorf Group celebrates its 75th anniversary. A good time to look back – and look ahead: in this context, Eppendorf is also dealing with major issues for the future. Questions that highlight the importance of the life sciences and the scientists´ work on the topics of tomorrow.

1945

Dr. Heinrich Netheler and Dr. Hans Hinz develop medical diagnostic products; in 1947 their company was renamed "Elektromedizinische Werkstätten GmbH".

1949

Eppendorf develops a photometer for clinical applications. Over time, it became a world standard for chemical and biochemical analyses.

1961

Eppendorf launches the first piston-stroke microliter pipette, heralding the age of precise and fast pipetting.

1963

A microliter system consisting of reaction vessels, mixers, centrifuges and pipettes is launched. It facilitates and improves laboratory work enormously.

How important is the past for the future?

"If I have seen further than others, it is by standing upon the shoulders of giants." This quote, made famous by Isaac Newton and which underpins the essence of science, is as relevant today as it was in 1675. It is only by looking at past methods, experiments, and results that we can learn from them and develop the research of the future.

The same principle applies to the manufacturers that support scientists in their work. This year marks the 75th anniversary of Eppendorf as a company – and in this time we have gained the trust of generations of lab users with our products. Some products have become indispensable in the laboratories of this world – such as the "Eppi®". The Eppi tube was invented in 1963 to help scientists handle the very small amounts of liquids that they were using and also to ensure that these samples could be safely stored. For this reason, the Eppi tube, as with all Eppendorf consumables, is manufactured to minimize the risk of chemical leaching.

Of course, as science and methods evolve, so too must our products, and so over the years we have built up different ranges of products covering all common lab procedures. Each individual product has been carefully designed with the help of scientists to suit specific lab techniques; the ep*Motion*® range of automated liquid handling systems is one of the more recent culminations of this process.

Designed to meet the rapidly increasing scale of genomics experiments, the ep*Motion* range is the product of over 50 years of experience in liquid handling, including award-winning designs and the invention of the microliter system – consisting of mixers, centrifuges and Eppendorf Tubes® for the processing of milliliter volumes of liquid. Genomic techniques, such as polymerase chain reaction (PCR) and next generation sequencing (NGS), are being used in an increasing array of applications thanks to increasing portability and speed, as well as reductions in cost. By replacing manual pipetting, the fast and easy-to-use ep*Motion*® systems help scientists meet the challenges of today and the future.

Following Eppendorf's principle that perfection lies in the details, we have now extended our product range to include smart-lab-software platforms: VisioNize® for monitoring lab devices and eLAB® software for lab information management. The result is a comprehensive range of equipment and services to help scientists stand upon the shoulders of giants. ■

What contribution does fundamental research make to our health?

How to ensure the quality of our daily needs?

How can we age more healthily in the future?

What does tomorrow's research look like?

ANSWERS TO YOUR QUESTIONS?

Please visit our website at

eppendorf.com/75-years

or any of our social media channels:

1963

The "Eppi®" reaction vessel is launched on the market. It quickly became indispensable in medical and scientific laboratories worldwide.

1978

The first Multipette® with Combitips® is launched on the market and becomes a bestseller.

1996

Eppendorf develops the air and oil micro-injectors CellTram – for pressure control during manual micro-injection and dosing of liquids.

today

Discover more product innovations online: eppendorf.com/75-years

INSIDE EPPENDORF

What Counts in Science?

Eppendorf talked to leading scientists to learn about the challenges they face in their daily laboratory work – and how they ensure the integrity of their results. Find out more about Talia Lerner´s thoughts, and take a closer look at the full article online.

When is a result truly a result? For Talia N. Lerner, PhD, Assistant Professor of Physiology at Northwestern University of Chicago, falsifiability is key: "Nothing is certain, ever. We work with hypotheses that are presumed true until proven false. If you haven't formulated a falsifiable hypothesis, you aren't doing science. For me, a 'result' is something that comes together when multiple lines of investigation point in the same direction. When very different experiments all fit into a model together, we begin to understand their meaning and can then form new hypotheses to test."

What do you do to optimize the quality of your results?
"All researchers build on each other's work", emphasizes Talia Lerner. "If we get something wrong, others will spend time going down a wrong path, too, or trying to prove us wrong. Ultimately, the quality of our results determines how impactful they will be." This is why quality in the laboratory matters all the time, at every single step. "If we want to help human patients, we need to be sure we are getting things right. We need to imagine how our results would translate into practical therapies. Proper controlling and careful note-taking are key", says Lerner. "I rely on my lab members to be careful observers, always looking for reasons an experiment might be contaminated." Her team does a lot to avoid possible systemic and measurement errors: "We can help each other do experiments in a blinded fashion, set concrete inclusion/exclusion criteria prior to analysis and scrutinize each other's work for flaws. And we work hard to verify that all our reagents are of high quality and our handling and analysis methods are standardized. Though, of course, it's always possible that there is something quirky about the lab", says Lerner. "In the end, cross-validation of our results by other groups is important."

"We need reliable laboratory equipment and – as I have mentioned – that allows for automation of manual labor", says Talia Lerner. She stresses that "everyday lab work can be repetitive and boring, but careful science depends on standardization. Some help comes from automation – increasingly, we can make computer programs and robots take over our manual labor and give us more time for creative thought. Until then, podcasts and labmates you enjoy hanging out with are lifesavers."

What makes science trustworthy?
Some people do not trust scientists, thinking they will fake experiments and work with made-up results. This has little to do with reality, though, if you ask people working in research. "Science is trustworthy because we test our hypotheses", explains Talia Lerner. "We are open to many explanations of the data we collect – and we actively try to determine which explanation might fit best our observations. While we are never 100 percent certain of a result – there could always be something we missed or an alternative explanation we have not explored – we are always willing to examine things critically."

Science only progresses when scientists check each other's work, if they replicate somebody else's experiment and build on the foundations set by their predecessors. Lerner sums it up: "People should never trust one study (scientists don't!), but they can trust that the enterprise of science as a whole builds towards truth."

A likely wise conclusion could be, opinions matter very little with regard to scientific results. We do not get to tell biology how it works; biology tells us how it works. ■

www.eppendorf.com/ScienceCounts

SHORT PORTRAIT

Talia N. Lerner, PhD, is Assistant Professor of Physiology at the Feinberg School of Medicine, Northwestern University in Chicago. Her main field of work is the decision-making of our brain: "The goal of my research is to dissect the synaptic and circuit mechanisms of habit formation. I want to know when habits are formed and how habits can be used adaptively to optimize an organism's survival strategy. Imbalance in habit formation mechanisms are hypothesized to be involved in disorders – such as obsessive-compulsive disorders, autism and drug addiction. Thus, our discoveries about this basic brain process may inform treatments for patients with these disorders." Professor Lerner is fascinated how we learn about our environment every day: "I think, the role of habit in our daily lives is often underrated."

MASTHEAD

Published by: Eppendorf AG, Barkhausenweg 1, 22339 Hamburg, Germany, **E-Mail:** magazine@eppendorf.com **Editorial team:** Julie Brahms, Florian Defren, Andreas Hochberger, Berrit Hoff, Ann-Katrin Kardinahl, Tanja Musiol, Svenja Sterneberg, Frank Thormählen, Thomas Uschkureit **Proofreading:** Redaktionsteam **Publisher:** TEMPUS CORPORATE GmbH, Helmut-Schmidt-Haus, Buceriusstraße, Eingang Speersort 1, 20095 Hamburg, Germany **Management:** Jan Hawerkamp **Project lead:** Jasmin Reuter **Chief Editor:** Natasa Ivakovic **Authors:** Ursula Barth-Modreker, Maren Beck, Andrea Hessler, Carola Hoffmeister, Susan Junghans-Knoll, Luca Pot d'Or, Michael Fischer, Sally Wilkens, Kristina Kara **Final Editing:** Frauke Franckenstein **Art Director:** Karin Mantel **Layout:** Lisa Natrup **Photo editor:** Katrin Dugaro Carrena **Printed by:** Dräger+Wullenwever print + media Lübeck GmbH & Co. KG
Image references: Titelbild Getty Images; p. 2–3 Eppendorf AG, Tony Luong, Getty Images, iStock; p. 4–9 iStock; p. 11 Dr. Kerstin Göpfrich; p. 12–14 Getty Images; p. 15 Hanns Hatt, Ruhr-Universität Bochum; p. 16–17 Getty Images; p. 19 Alexander Glandien; p. 20 Luise Jakobi; p. 21–23 Alexander Glandien; p. 24 iStock, PR; p. 25–29 Eppendorf AG; p. 30 iStock, PR; p. 32 Eppendorf AG; p. 33–35 Tony Luong; p. 36 Getty Images; p. 37 Privat; S. 38–39 iStock, p. 40–41 iStock; p. 42–43 Getty Images; p. 44–45 iStock; p. 46–47 iStock, alamy, Elbphilharmonie Maxim Schulz; Elbphilharmonie Iwan Baan, tibreizh.de, speicherstadt-kaffee.de, ontherugs.de; p. 48–49 Getty Images; p. 50–51 Eppendorf AG, PR

INSIDE EPPENDORF

Lab Lifestyle

1

1 Holding on to Great Ideas!

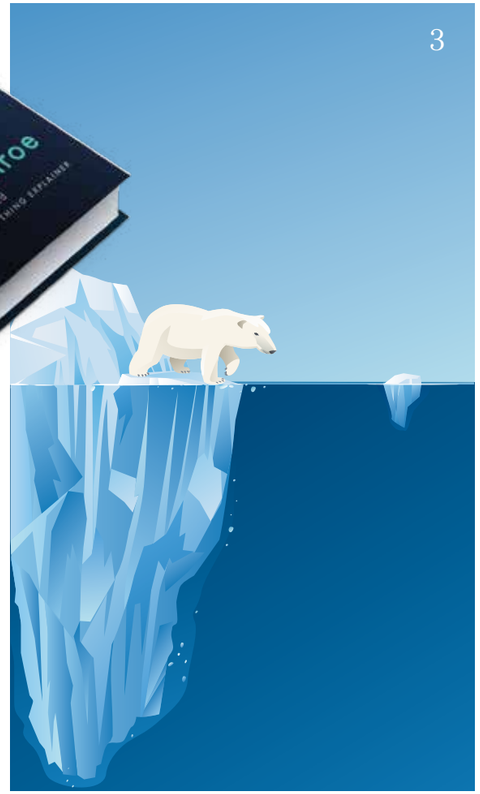
As we all know the best ideas often come unexpectedly. And if you have your "Bamboo Folio" on hand when you have a flash of inspiration you can use the pen to write down a note that is digitized thanks to the Smartpad. And you can save it to the Cloud so that it is accessible at any time. Magic? No, it's smart technology. Cost: from 149 Euros. **https://bit.ly/2S5i1Ov**

2

2 Everyday Science

Why make it simple if you can make it complicated? The author Randall Munroe has already made a name for himself with his bestseller "what if?". In his new book "how to" he uses his famous stick-figure drawings to explain how to use scientific and technical phenomena to deal with everyday problems. An example: if you would like to find out whether you belong to the baby boomer generation or if you are a child of the nineties just have the radioactivity of your teeth measured. A little absurd, surprising – and definitely funny!
"how to", 384 pages, published by Penguin, approx. 16 euros.

3



LOTTERY

! Lottery

With its OEM division, Eppendorf offers high-quality customized solutions. Design and function are geared to the special requirements and needs of customers. You can find more about OEM on the following website **www.eppendorf.com/oem.**

What do you expect from an Eppendorf OEM product? Tell us your ideas and requests and you will have a chance of winning one of our popular Moleskine® notebooks including a LAMY® pen!

Send us an e-mail to magazine@eppendorf.com or register as a subscriber and leave us a message with your answer. The conditions of participation can be found on our website.

www.eppendorf.com/otb

3 "Global Warming Sucks!"

I am standing in the spotlight of a science slam and saying in clear words – away from science – what I feel as a climate scientist.

But let's start at the beginning: I am a geoscientist and I am researching molecular algae remains in the Antarctic. When ice algae die they sink to the bottom of the sea and remain there for thousands of years. By analyzing the bottom of the sea I can identify geological phases in which there were a lot of or few ice algae (and sea ice) present in the Antarctic and how this interacted with the global climate system. These findings markedly improve climate forecasts for the following reasons: if the sea ice retracts, the land ice begins to melt and sea levels rise enormously. This affects half of the human population as coasts attract settlements and we find food, resources and recovery.

The melting of the ice sheet is a process that occurs with a slight delay to global warming. Even if the cause was to be eliminated the great melting process would continue over centuries. Slowing down the warming is all the more important, there is no way back now. If no drastic measures are taken in this decade to protect the climate and if the climate system destabilizes it will be virtually impossible to influence the process. It means that mankind will have gambled away its last chance for a peaceful future.

The exploration of the sea and climate is my absolute dream job and to share this knowledge with a broad audience is my passion. When I explain what a dangerous game people are playing with their livelihoods, the question often arises: what can we do? The biggest greenhouse gas emissions come from the transport and energy sector, and it is difficult for individuals to change that. However, there is one way to become active today: calculate your CO_2 footprint on the homepage of the Federal Environment Agency and reduce it to one ton of CO_2 per year. You will see that your life will change fundamentally.

Maria-Elena Vorrath is studying for a PhD on the climate history of the Antarctic at the Alfred Wegener Institute. She uses Science Slams and lectures to explain what happens during global warming.

bit.ly/2qV9ELF

News Ticker

Innovations, new developments, media-related added value: a summary of news and innovative products from Eppendorf.

Optimized App

The Eppendorf app uses the latest technology to become even more user-friendly: it has now become even easier to find and compare products and to virtually place them in your lab thanks to the improved AR function*. More highlights:

- Registering all of your Eppendorf devices made easy
- Scan your epPoints® quickly and easily
- Use the revised epT.I.P.S.® or ep Dualfilter T.I.P.S.® single-use racks to calculate the amount of crude oil/polypropylene that could be saved

**Your device needs the operating system IOS 13.0 or higher.*

Download now on:
www.eppendorf.com/app

Innovative and Intuitive

As the innovation cycles in research and digitization get shorter, the software and hardware of lab devices also need to be updated continuously. The SciVario® twin is our latest control unit for controlling your bioprocesses. You can control up to two devices individually or in parallel. Thanks to the innovative bay-drawer system you can adapt your system at any time, individually and flexibly to your current requirements. Benefit from digitization and experience a complete new, intuitive user-interface. Step-by-step guidance with VisioNize®-onboard mitigates the risk of operational errors.
www.eppendorf.com/scivario

Perfect Form

The epT.I.P.S. pipette tip box – refillable and autoclavable, it has been an indispensable part of many laboratories since 2002. So it is time to give this jewel a more modern design. The new box in a bright white colour with clear lines, newly designed closing button and bluish coloured transparent lid fits perfectly into modern laboratory equipment. The new disposable rack from epT.I.P.S. comes in the same design style. Here the main focus was on reducing the amount of the raw material polypropylene as far as possible without compromising its stability and strength.

The Power of Touch

With her research, Lauren Orefice wants to contribute to the improvement of treatments for autism disorders. The young neurobiologist aims to uncover the influence that the sense of touch has on those affected. ▸

There are few things more comforting than a hug, more encouraging than a pat on the shoulder or as relaxing as a gentle caress. Touch is magic – light as a feather yet effective; invisible yet perceptible. Long before people are able to hear or see, they can feel – for the tactile sense is the first sense that develops inside the uterus. "It is the sense of touch that allows the very first interpersonal exchange, and one could go so far as to say that social development begins with touch", says Lauren Orefice. Sensations are essential, just like the air we breathe. "Touch is absolutely critical for normal brain development and also for social behavior." This is exactly why touch made its way into Lauren's scientific heart.

In the beginning, it was mere curiosity and enthusiasm that enticed the American, who was raised in New Jersey, to study Biology at Boston College. A research career was definitely not on the horizon at the time. Only after she transferred to Georgetown University to pursue her PhD in neuroscience, did it become clear that she would be the first in her large family to choose a scientific career path.

Physical contact as a threat

For her postdoc, Lauren Orefice joined the laboratory of Dr. David Ginty at Harvard Medical School, the very same institution where today, at barely 35, she leads her own research lab. Within the Department of Genetics, she studies the development, the function and the weaknesses of somatosensory circuits. These circuits encompass the wiring which instructs the tactile sense as well as perceptions. Lauren wants to uncover the influence that the tactile sense has on autism spectrum disorders (ASD). While most humans instinctively yearn for touch, physical contact is experienced as unpleasant, threatening, and even painful, by many people with autism.

"A marked change in sensitivity to sensory stimulation is a symptom that is frequently overlooked but very common among patients with ASD", explains the scientist. Approximately 85 percent of patients react in an extremely sensitive way to even the lightest touch. Simply brushing against another person in a crowded store may be torture for someone with autism. Some people experience a gust of wind as burning and heavy rain as painful; even a haircut may be difficult to endure. These are the realities that drive the researcher. It is her goal to make a contribution towards making autism spectrum disorders more amenable to treatment. It is to this end that she ponders a project hour upon hour, that she observes neurons engaged in networking – and that she discovers, uncovers, analyzes and evaluates them.

Touch is essential for the normal development of the brain and social behavior."

Lauren Orefice

Dampening overreaction

This was how Lauren and her team were able to correct decades-old ideas about the causes of ASD. They were able to prove

Research according to plan
Lauren Orefice investigates the development and function of the circuits that train our sense of touch

Solutions from the laboratory
Lauren Orefice and her team hope that their research on the sense of touch will lead to new therapeutic approaches for the treatment of autism spectrum disorders

that autism spectrum disorders are not caused exclusively by aberrant brain function, as previously assumed. In fact, peripheral somatosensory neurons – those nerve cells outside the brain which control the sense of touch – also play a critical role. In experiments involving mice, the scientist was able to show that these touch neurons are impaired in certain manifestations of ASD and thus lead to altered sensory behavior.

True to her life philosophy "there's more to it", Lauren has simultaneously pulled a therapeutic approach out of her scientific hat. It takes the shape of the compound Isoguvacine. The experimental compound which to date is only approved for use in clinical trials, is capable of reducing the activity of sensory neurons and thus dampen excessive reactions.

A masterpiece achievement

Lauren modestly describes her work as "hopeful", as a "possible therapeutic path to treat specific features of autism." At the same time, her work has inspired the scientific community. Professor Mark Wallace of Vanderbilt University in Nashville, Tennessee, was among those who praised her work: "This study is a technological masterpiece." The Eppendorf AG honored the work by presenting Lauren Orefice with the Eppendorf & Science Prize for Neurobiology, worth $25,000.

Lauren's life revolves around her lab. If she is not physically present, she is thinking about it. She can hardly suppress a smile as she recounts: "Having a smartphone is helpful if you come up with an experiment idea while in the grocery store." She likes to enjoy life, even at work: in the fall, the lab held a pumpkin carving challenge; in January, the lab celebrated its first birthday, labiversary, and on Wednesday nights, everyone gathers "pretty regularly for wine and cheese Wednesday".

Research thrives on humor

It is no wonder that occasionally there is not enough time for her husband – but he understands his wife's ceaseless scientific curiosity and her love for the lab. After all, a neuroscientist himself, he is equally electrified by the miraculous world of the nervous system. Together, they share their love for Pippa: "She's adorable, extremely loving, and keeps us very busy", Lauren says about her female Staffordshire terrier, who entertains her on hikes and walks in her spare time.

Where can the researcher still clear her head? "I have recently started taking ballet lessons again as a different way of expressing myself creatively. A good cup of tea and a phone call to my family works wonders too." Support from the family is just as important for her work as curiosity, creativity and perseverance. Oh, yes, "and a good sense of humor" – as a researcher, you could always use a pinch of that. ■

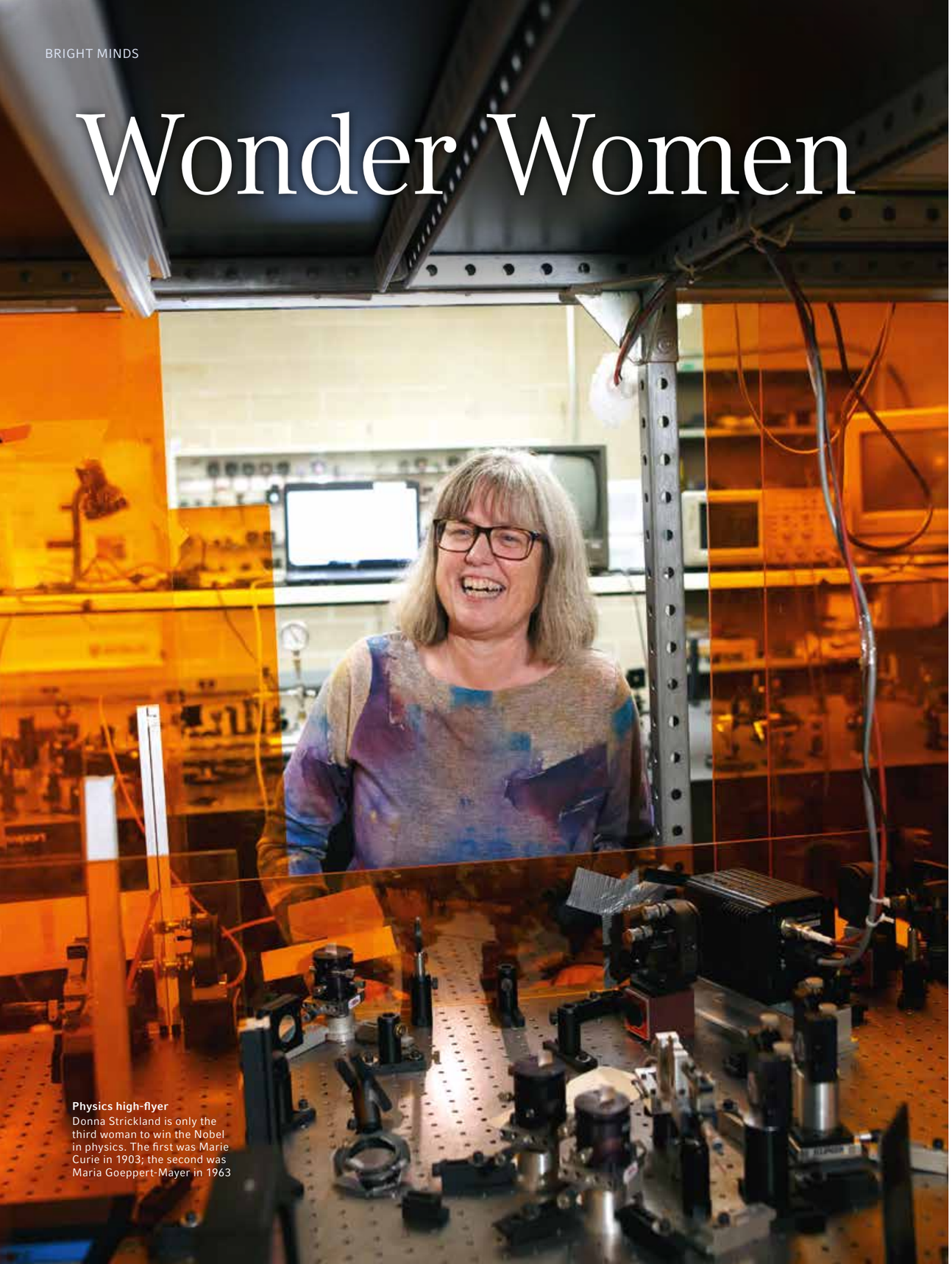
Drawing from the full
Lauren Orefice uses a number of techniques in her laboratory, including molecular biology, electrophysiology and behavioural research

LEARN MORE?

Click here for the website

www.oreficelab.org

Wonder Women



Physics high-flyer
Donna Strickland is only the third woman to win the Nobel in physics. The first was Marie Curie in 1903; the second was Maria Goeppert-Mayer in 1963

Jess Wade leads a double life. She is polymer physicist during the day. At night, she fights for better representation of women and people of color on Wikipedia.

Dr. Wade, your regular job is researching light-emitting diodes (LEDs). Since early 2018 you have edited more than 850 Wikipedia entries about female scientists in the evenings. What is the motivation behind your second occupation?

Jess Wade: Eleven percent of physics professors in Great Britain are women. As a physicist, I see the underrepresentation of women and people of color on a daily basis. I read Angela Saini's book "Inferior: The True Power of Women and the Science That Shows It" in 2017. It points out the stereotypes that have excluded women from contributing to science and society. Around the same time, I met Dr. Alice White, a Wikipedia editor who explained to me how influential this platform is. English Wikipedia gets 32 million page views a day, but about 90 percent of the content is created by white men in North America. Only 18 percent of the biographies on English language Wikipedia are about women.

How do you find out about the people you would like to write about?

Wade: Sometimes it's seeing people speak, sometimes it's from social media, sometimes it's reading newspapers or journals or magazines. This is how I find out whether someone has won a prestigious award or done a big lecture or published a really interesting scientific paper. In the evening, when I come home from the lab, I start researching. There are people who are easy to find and some who need more extensive work. But those who are trickier to research can prove to be a bit more interesting. There are a lot of people that have done incredible things in science but have not had the coverage that they deserve yet.

Do you have a favorite discovery?

Wade: Physicist Donna Strickland won the Nobel Prize in 2018. She didn't have a Wikipedia page until the day the award was announced. An editor had rejected a submitted entry, claiming the subject did not meet Wikipedia's notability requirement. My favorite recent entry was the physicist June Lindsey, a Cambridge and Oxford crystallographer, who was influential in the discovery of DNA structure in the 1940s. In spite of being real scientific royalty, she left science completely to look after her two children. It wasn't until a Canadian pediatrician met her at his mother-in-law's 90th birthday party, that her story went mainstream. I found out, and now she's on Wikipedia.

Have you ever given up on anyone?

Wade: I stop when I get the feeling that I don't like the person or when I think they are really arrogant or big on self promotion and don't need more public coverage. I also stop when it becomes apparent that although I might think that they are important, they don't meet Wikipedia's strict notability criteria. For example scientists must have published a number of papers, they have to be named professor and they have to have won an international award. This rules out women and people of color particularly because they don't get enough public recognition or grants.

Do you think that Wikipedia needs to change its rules?

Wade: I think that the rules are actually OK. They just reflect our society which is not equal. The problem is that we don't give enough recognition to women or people of color. So, I think we should actually keep the same criteria, but get better in awarding women and people of color more fellowships and more significant science awards. The online encyclopedia is the only peer-reviewed, crowdsourced, democratized access to information worldwide. If you put content on there, people don't only read it, it changes their perception about who they think does science and what they think science is.

Have you ever experienced criticism for your edits?

Wade: Definitely. Unsurprisingly, Wikipedia editors don't like being told that they are sexists or racists. Some claim that by adding more women's biographies I would be making the website worse instead of better. They argue that if we have a gender gap in society, Wikipedia should reflect that. So they respond badly. I think this is something that I can win by turning it into something good.

When will you stop?

Wade: That is a really good question. I don't know. I used to play on my computer and do video games when I needed some down time from my day job. Now I find that Wikipedia is just the most productive thing to do. I love learning about different periods of science I would otherwise have no opportunity to interact with. I will keep going until I stop enjoying it. Hopefully along the way I will have trained and motivated enough people who want to contribute. ■

SHORT PORTRAIT

Dr. Jessica Wade graduated in physics, chemistry and art. She then lived in Florence and took classes in art and art history. This is where she learned about people like Leonardo da Vinci who was an artist, architect and scientist at the same time. She returned to science for her master's degree and finished her PhD in May 2016. She then took on a job in educational policy for six months but figured instantly that she had to have a reseach job and returned to the Blackett Laboratory at Imperial College London.

Science in Your Ear

Whether it is comedy, culture or a personality show – many, mostly young, listeners love podcasts. But – are these any good at communicating science? Benjamin Thompson of "*Nature Podcast*" says: Yes!

Benjamin Thompson is a curious spirit. Since 2017, the Doctor of Microbiology has hosted the "*Nature Podcast*", which belongs to the scientific publisher Nature Research. "I love two things", says 40 year-old Thompson, "learning about the latest topics in science and telling stories." With this, he succinctly summarizes the main components that come together in the *Nature Podcast*. But what is it that differentiates the audio format from the large numbers of journals and magazines published by Nature Research? In other words, from the digital and print publications that one must read, line by line. In strict scientific tradition, the answer first leads to the definition.

Subscribable files

The podcast is a fairly new addition to the history of media. Even though audio formats are most often associated with the term, podcasts also include videos. Per definition, podcasts comprise media data that one can automatically access via a web feed. Storage and distribution of podcasts are thus Internet-based and differ from classic analog radio. According to a common explanation, the name "podcast" is composed of the English "to broadcast" and the latter part of the brand name "iPod". At the time of the inception of podcasts, in the early 2000s, this portable MP3 player by Apple was a common tool with which to listen to such podcasts. A different definition of "pod" – the acronym of "play on demand" – also fits the bill. Once subscribed to, podcasts are available at any time via a suitable device such as a smartphone or tablet.

Benjamin Thompson, himself a passionate listener of podcasts, considers this to be a huge asset of the medium: "Many people listen to podcasts while traveling or while they exercise." They thus fill "dead" time or routines with entertainment or knowledge. The latter is provided by the *Nature Podcast* once per week. The regular show illuminates the most exciting scientific news. "Our production process always starts on Wednesdays", says the reporter, "that's when we sit together and hold our editorial meeting to discuss which two or three topics from the current *Nature* publications will be included in the show."

Distilling knowledge

The constant challenge: how to distill a lengthy paper written in scientific language into an interesting six to seven minute-long audio story? Thompson follows his instinct: "I ask questions to which I myself would like to know the answer." Every new topic involves interviews with scientists from all over the world. Thompson and his colleagues then weave the story around these contributions. One day, it's the mathematical three-body problem; another day, it's the genome of butterflies – the range of topics is as broad as science itself. Typically, the scientists enjoy being available to talk about their discoveries; most scientists join the *Nature* team via phone. At the Nature Research branch in London, the team occupies a small studio – which affords it the necessary quiet time to conduct telephone conversations of acceptable sound quality. "Only the time difference can at times be a bit of a predicament", laughs the host of the show.

In addition to the news show, there are other recurring formats; for example, the monothematic discussion round "Backchat". Or "PastCasts", which tell the best stories behind the stories from the *Nature* archives. Since its beginnings in 2005, more than 600 episodes have been produced, and a broad and diverse base of regular listeners has been established. The latter is really the crux of the matter when it comes to employing podcasts: their success, in terms of reach, is difficult to measure. Numbers of downloads, for example, do not reflect on whether or not an episode was actually listened to in its entirety. At Nature Research, however, the podcast is a fixed component of the entire output, and it complements the magazine world. "We are fortunate in that we are able to focus entirely on the quality of good stories", says Thompson.

Even though he came on board only three years ago, he is a podcaster through and through. While working for his previous employer, the Microbiology Society, he was responsible for the podcast "Microbe Talk" – a very specialized subject. In practice, moreover, he learned to appreciate another advantage of the medium: the enthusiasm of the scientists who are being interviewed is palpable in a much more personal and direct manner. "It is a very personal matter; you broadcast directly into the ear of the listener." ■

PODCAST TIPS FROM BENJAMIN THOMPSON

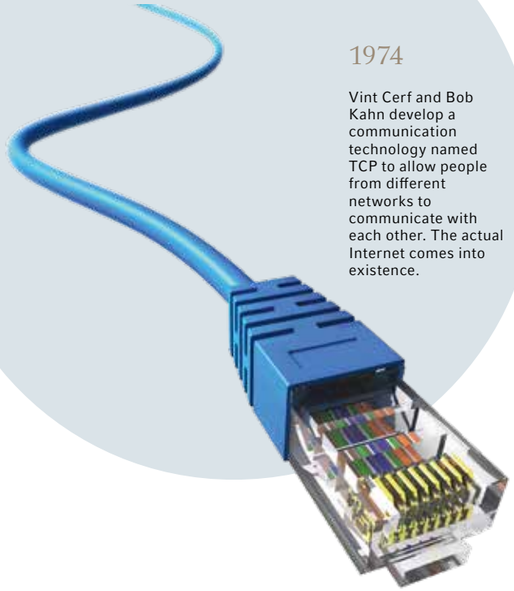
- "Ask yourself who should be your target audience. Whom would you like to address? All your stories should be geared towards your listener base."
- "There are already many podcasts on various topics. Find your niche! Make what you know, what you're good at and what you enjoy be your podcast topic."
- "Aim for regularity, but be realistic. You're unlikely to be able to produce an episode a day, so go for once a week, or once a month when you start out."

1969

The student Charles S. Kline transmits a message from a computer at UCLA in Los Angeles to another computer located roughly 500 kilometers away at Stanford Research Institute (at the time, computers were still significantly larger than the Macintosh model of the 1980s).

1972

Ray Tomlinson introduces the first e-mail to the net. He chooses the "@" symbol to label different users' addresses.



1974

Vint Cerf and Bob Kahn develop a communication technology named TCP to allow people from different networks to communicate with each other. The actual Internet comes into existence.

1989

British physicist Tim Berners-Lee presents the idea of the WWW (World Wide Web) at the European Research Center CERN.

2016

In October 2016, the number of Internet searches via mobile devices surpasses the number of Internet users with desktop devices for the first time.

50 Years of Internet

From the first message, to roughly four billion Internet users worldwide, it has come a long way: a retrospective review of 50 years of Internet – and a brief preview.

Only a few months after astronauts Neil Armstrong and Buzz Aldrin in Apollo 11 were the first humans to land on the moon, student Charles S. Kline of the University of California at Los Angeles sent a message with the text "Login" from one computer to another, located 500 kilometers to the north at Stanford Research Institute – the Internet was born. "We knew that we were developing an important new technology which was expected to be useful to a subset of the population. But we had no idea how significant the event really was", Kline's boss, Leonard Kleinrock reported later.

The reason is that prior to this event, this kind of exchange of information had only been possible between structurally identical computers with the same operating system. The network of the Advanced Research Projects Agency (ARPANET), the precursor to the Internet, suddenly enabled the connection of all computers – even across great distances. "Beginning with this short message, the Internet can look back on an unprecedented triumph", recounts Armin Grunwald, Head of the Office of Technology Assessment at the German Bundestag (TAB). "Nobody has set foot on the moon since 1972 whereas the Internet is used by roughly four billion people every day."

Initial research purpose

Initially, the success story of the Internet was anything but a linear path. From the first transmitted message to today's Internet with the well-known browsers, apps and functions, it has come a long way – also in terms of time. One of the reasons was the fact that the original purpose of the Internet was the facilitation and simplification of communication between research institutions worldwide. Even the United States Department of Defense was involved during the first decades; it was hoping for a network that would be able to withstand large-scale outages following an enemy attack. The scientists who were tasked with furthering the development of the Internet in subsequent years were unsuccessful in eliminating a substantial security defect. To this day, the protocol does not contain any built-in security functions. "In practice, it is expected that everyone will trust everyone else on the Internet", Grant Blank of the British Oxford Internet Institute said to the magazine "New Scientist".

Caution: Internet

The trust of consumers, however, took a hit in the decades that followed. As a result of the rapidly growing numbers of users, not only commercial interests, but also crime and abuse, were on the rise. Even before 1989, when the World Wide Web and – a few years later – the first browsers began to considerably simplify the use of the Internet, the first computer viruses had already begun to circulate. And the more users went online in the years that followed – there were already 500 million in 2002 – the more viruses, worms, hacker attacks and misuse of data emerged.

"Today, of course, we are much more aware of the downsides of the Internet", explains Grunwald of TAB. In the future, the potential for danger will lie within the power positions of tech giants such as Google®, Facebook® and Amazon® that own massive amounts of user data: "We depend on these companies' abilities to satisfy their responsibilities regarding data security, however, we have already been disappointed in the past. National, but also European, solutions are crucial. "In addition, the relocation of entire industry sectors into the digital realm carries risks, states Grunwald: "Even today, there are targeted attempts of attacks on important institutions and supply networks. You really don't want to imagine in detail what will happen if the energy supply were to collapse due to, for instance, a hacker attack."

On the other hand, says Grunwald, the dangers of the Internet should not blind us to all the advantages which the Internet affords people and which have long been taken for granted: "The Internet is the dream of limitless freedom. People across the globe are connected and have access to knowledge and education. The world will continue to consolidate and become smaller." Indeed, according to predictions by different sources, more than 100 million additional people will have access to the Internet by 2021. Ever cheaper technologies and the advancing distribution of networks will strengthen this trend in the near future. Grunwald: "This dream of the world as a global village is no longer a mere Utopia. It is now up to us whether, and how, we will further realize the dream." ■

MORE ON THE TOPIC

Internet as a Human Right?
More than half of the world's population uses the Internet – tendency rising. The standard of living in many countries and regions depends on it to a large extent. "Internet access is not a luxury but a simple human right. Everyone should have uncontrolled and uncensored access to this global medium", comments Dr. Merten Reglitz, philosopher and ethicist at the University of Birmingham, in a current study. His team investigated whether Internet access represented an essential necessity for humanity. According to Reglitz, Internet access is also a prerequisite for the ability to safeguard other human rights such as the freedom of speech, the freedom of information and the freedom of assembly.

Differently Sick

When women suffer a heart attack, it often goes unrecognized. Men set the standards in medicine – in diagnostics as well as therapy. Why is that?

A 40-year-old hairdresser suddenly complains of nausea, chest pains and copious sweating while at work. She goes to the bathroom and hopes that things will improve. Her family doctor diagnoses stomach upset. Days pass. Following a blood pressure measurement at a local pharmacy, a heart attack is diagnosed in a cardiac outpatient clinic. Two weeks had passed!

Women!

This typical example shows that on the one hand, women tend not to take their heart problems seriously. After all, they believe that a heart attack is only accompanied by a strong sensation of tightness in the chest as it is experienced by men, as well as with pain radiating into the left arm. Furthermore, medical professionals are less likely to suspect a heart attack in a woman, which is why emergency procedures are often initiated too late in the case of female patients. Studies show that emergency first responders are also less willing to perform heart pressure massage on a woman – likely due to uneasiness surrounding the female breast. The consequence: more women than men die following a heart attack.

According to statistics, the chances of recovery from diseases of the heart and circulatory system are about half as good for women as they are for men. The clinical picture manifests serious differences: the sudden cardiac arrest of an athlete mainly affects men, while stress-induced heart disease – by now well-known as the "Eve attack" – is 90 percent a women's issue. It is a fact: women's illnesses are not quite the same. Autoimmune diseases, depression and osteoporosis are considered classic women's illnesses. Even in the case of gastrointestinal cancer, recently discovered gender-specific differences revealed that women continue to be at risk into old age. For this reason, Professor Thomas Schiedeck, President of the German Society for General and Visceral Surgery, demands a shift in the current statutory provision which applies to screening for gastrointestinal cancers: men would be recommended to be screened even prior to turning 50, whereas women would be screened well past their 75th birthdays.

"The symptoms experienced by women frequently do not correspond to what is written in the very male-centered textbooks", explains Dr. Vera Regitz-Zagrosek, Professor of Cardiology. The 66-year-old is considered a pioneer; she initiated the first German Institute for Gender Research in medicine. It was the year 2003, at the Charité Hospital in Berlin, two years after Sweden had founded the first European Institute for Gender Medicine. In Germany, gender medicine still leads a niche existence. Scandinavian countries and Switzerland, as well as Canada and the United Nations, are miles ahead. In these places, for example, research proposals are only approved if they consider gender-specific differences.

Medicine – a man's world

It can be a matter of life and death. Even with medication, there is that little difference – with, at times, serious consequences. Digoxin, a common medication used to treat cardiac insufficiency, may even reinforce heart problems in women. Medications against high blood pressure exhibit stronger side-effects in women. And while common Aspirin is an effective prophylactic against heart attack in men, it does not work in women. The sleeping medication Zolpidem causes a strong hangover in women – women are only prescribed half the dose. To this day, most package inserts do not address this issue.

The reasons are of a biological (see info box) as well as political nature: the majority of doctors are male. Women are also underrepresented in guideline committees where treatment standards are defined. Furthermore, since men dominate the scientific societies, research continues to be a man's world. It is therefore no surprise that it is mainly young male mice which are tested in pharmaceutical studies, and that medication is optimally tailored to young men. Vera Regitz-Zagrosek emphasizes: "Gender medicine is not intended to be women's medicine." The goal is to develop better medications for men and women. ■

BACKGROUND

Biological differences such as height, fat content, hormones and enzyme structure are among the reasons why medications are taken up differently by women. Even the journey of a substance to the liver is considerably longer in a woman. In addition, medications react differently with the sex hormones – testosterone in men, estrogen in women. There is also considerable interplay between biological ("sex") and socio-cultural ("gender") criteria, including toxins, smoking and stress. "Overall, female cells deal better with environmental influences", explains Vera Regitz-Zagrosek, Professor of Gender Medicine. Thanks to the double X chromosome, female cells developed protective processes, which should now also be harnessed for men.

Historic Warehouses

Hamburg, in Germany's north, is famous not only for the Reeperbahn, its port and the Jungfernstieg, its magnificent boulevard, but also for the landmark Speicherstadt, a heritage warehouse district from the 19th century.

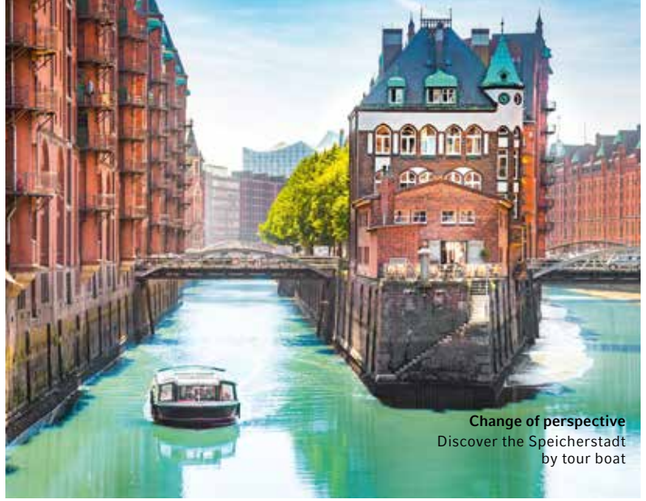
Waterside, from the air
Hamburg scenery including parts of the harbor, the Speicherstadt and the city's landmark, the Elbphilharmonie concert hall

Lustrous red brick buildings with turrets, bay windows and green copper domes jostle for space. They rise above thousands of oak pilings in the midst of the port of Hamburg, and those who stroll among them, through the cobblestone alleys, will catch the scent of roasted coffee and the salty water of the river Elbe. Above their heads, seagulls cry and tell of the nearby ocean. Welcome to Hamburg's Speicherstadt, the largest warehouse complex in the world! Two miniature castles of Wilhelmian splendor await the visitor, along with a profusion of exhibits, restaurants and cafes which have found a home on the creaking floors of the old warehouses.

The Speicherstadt arose after the Hanseatic city had lost its free trade status and joined the German Customs Union in the mid-19th century. Since the citizens of Hamburg wanted to continue to store tobacco, coffee, cocoa and spices free of duty within its free port, they built sky-high warehouses on two islands in the river Elbe. Approximately 20,000 people had to be moved to accommodate the project. Hamburg was henceforth known as Germany's "Gateway to the World". In 1991, the Speicherstadt was classified as a historical monument; in 2015 UNESCO® declared it, together with the neighboring Kontorhaus district, a World Heritage Site.

Castles in the Speicherstadt

The Speicherstadt boasts two castles: the fairytale miniature Wasserschlösschen (moated castle), with its delicate clock tower, was built at the location where Wandrahmsfleet (canal) and Holländischbrookfleet meet. It was built in 1899 in Brick Expressionism style, and it housed not royalty, as may be suspected from the splendor; in fact, it was the guardians of the winch who lived here and who were responsible for maintaining the hydraulic warehouse winches. A green varnished door with latticed windows leads to the inside of the building. Visitors find themselves inside a quaint shop with creaking floorboards and shelves that are several meters high. Here, in the Teekontor ►



Change of perspective
Discover the Speicherstadt by tour boat

Panoramic view
From the Plaza (r.) of the "Elphi" (l.) the whole city in view

("tea office"), tea from all over the world is offered for sale. More than 250 varieties are available, and accordingly, the scent of many flavors wafts through the air: caramel, rooibos, bergamot. The staff are happy to explain which mixes can be found in the beautiful bags with the melodious names. Elbufer (bank of the Elbe River), for example, tastes of peppermint, blackberry, rose, lemon and raspberry.

Those who can't get their fill of small castles can walk a few steps to the Fleetschlösschen on the corner of Brooktorkai and Sankt-Annen-Brücke. Located between the mighty warehouses, directly next to a pedestrian crosswalk, the little house with the pointed roof looks more like a forgotten toy. Inside the building – the former seat of the customs office – you will now find a café. It is worth having a break for a while, even outside, to take in the view of the waterway and feel for a moment like the resident royalty.

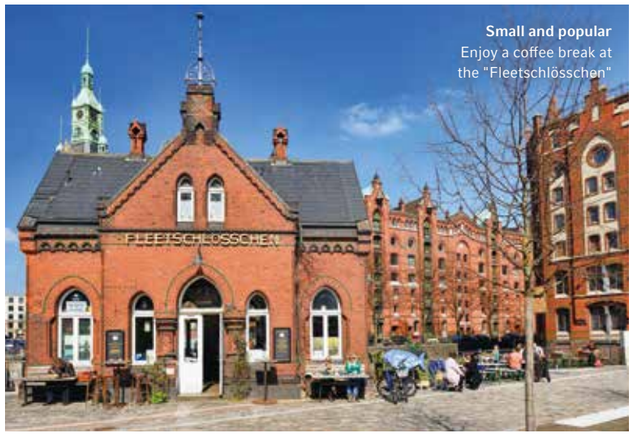
History with a scare-factor

Long lineups have formed in front of the "Warehouse of Culture" at Kehrwieder, which confirm the statistics of visitor numbers: the "Dungeon", a chamber of horrors, and "Miniatur Wunderland®" are two of Hamburg's most popular attractions at the Speicherstadt. In the "Dungeon", actors illustrate the history of the Hanseatic city. Visitors relive the great fire of 1842, the execution of the pirate Störtebeker on Grasbrook Island in 1401, or the era of the plague. The "Miniatur Wunderland", on the other hand, houses the world's largest computer controlled model train complex. It comprises 15.2 kilometers of track, 260,000 figurines, 130,000 trees and 1,380 signals – even 900 couples trysting in the woods.

Sparkling beauty of the Elbphilharmonie

In the immediate vicinity of the Wilhelmine splendor of redbrick Gothic, you will find the Elbphilharmonie – the heart of Hafencity, the new quarter framed by Speicherstadt, Elbe and Mönckebergstraße. Elphi, as it is endearingly known, is now considered to be Hamburg's new landmark; as a glass wave, it towers above an old warehouse in which, until the 1960s, cocoa, coffee and tea had been stored. In the evening hours, it glistens like a crystal before a pink sky, and the stars who perform here are also in awe. "Gorgeous!", exclaims Soprano Cecilia Bartoli, who has sung Rossini and Vivaldi in the concert hall that is built to resemble a vineyard. "I hope to come back to Hamburg many times in the future!"

Particularly beautiful, and accessible without a concert ticket, is the observation deck plaza along the juncture connecting the brick warehouse to the new glass construction. It leads you around the building in the open air, and its view of the bell tower of St. Michaelis church and the busy cranes in the port of Hamburg are simultaneously priceless and free, as is the ride up to the plaza. It leads through a tunnel studded with glass sequins on the only curved escalator in the world. Afterwards, the concert house and the view of Hamburg can be appreciated from the water: simply walk over to the dock "Elbphilharmonie" and take ferry 72 to Landungsbrücken. Ahoy! ■



Small and popular
Enjoy a coffee break at the "Fleetschlösschen"

! HAMBURG – THE BIRTHPLACE OF EPPENDORF

Eppendorf was founded in Hamburg in 1945 – to this day the company's headquarters with more than 3,600 employees worldwide, ten production sites and subsidiaries in 26 countries. Eppendorf Liquid Handling GmbH and Eppendorf Instrumente GmbH are also based in the Hanseatic city, as is the logistics center in Rahlstedt and one of the Partner Brands. In Hamburg Hummelsbüttel, the headquarters of the Eppendorf Group, approximately 1,000 employees from various departments, such as development and production, service and marketing or quality management and finance, as well as human resources management contribute to the global success of the company.

LET'S GO!

Typical Speicherstadt: all things delicious and precious

The crêpery **Ti Breizh** is located in a merchant building dating back to the year 1700, directly adjacent to the Nikolaifleet in the landmarked Deichstraße. Translated "House of Britanny", visitors can order not only sweet crêpes and savory galettes, but also fish soup, marinated sardines or salad with goat cheese. The generously laid out restaurant, which stretches across two levels, also hosts regular art exhibits.

Deichstraße 39,
20459 Hamburg

www.tibreizh.de

Roasted coffee beans emanate a nutty, seductive aroma that leaves no room for doubt: Kehrwieder 5 is home to what is likely the most famous **Speicherstadt Kaffeerösterei**. It resides in the vast space of an ancient warehouse with rustic oak floors, the center of which contains piles of gunny sacks and packages filled with coffee. This is the place to sample delicious specialties such as Kopi Luwak from Indonesia which may cost more than 200 Euros per kilogram retail.

Kehrwieder 5,
20457 Hamburg

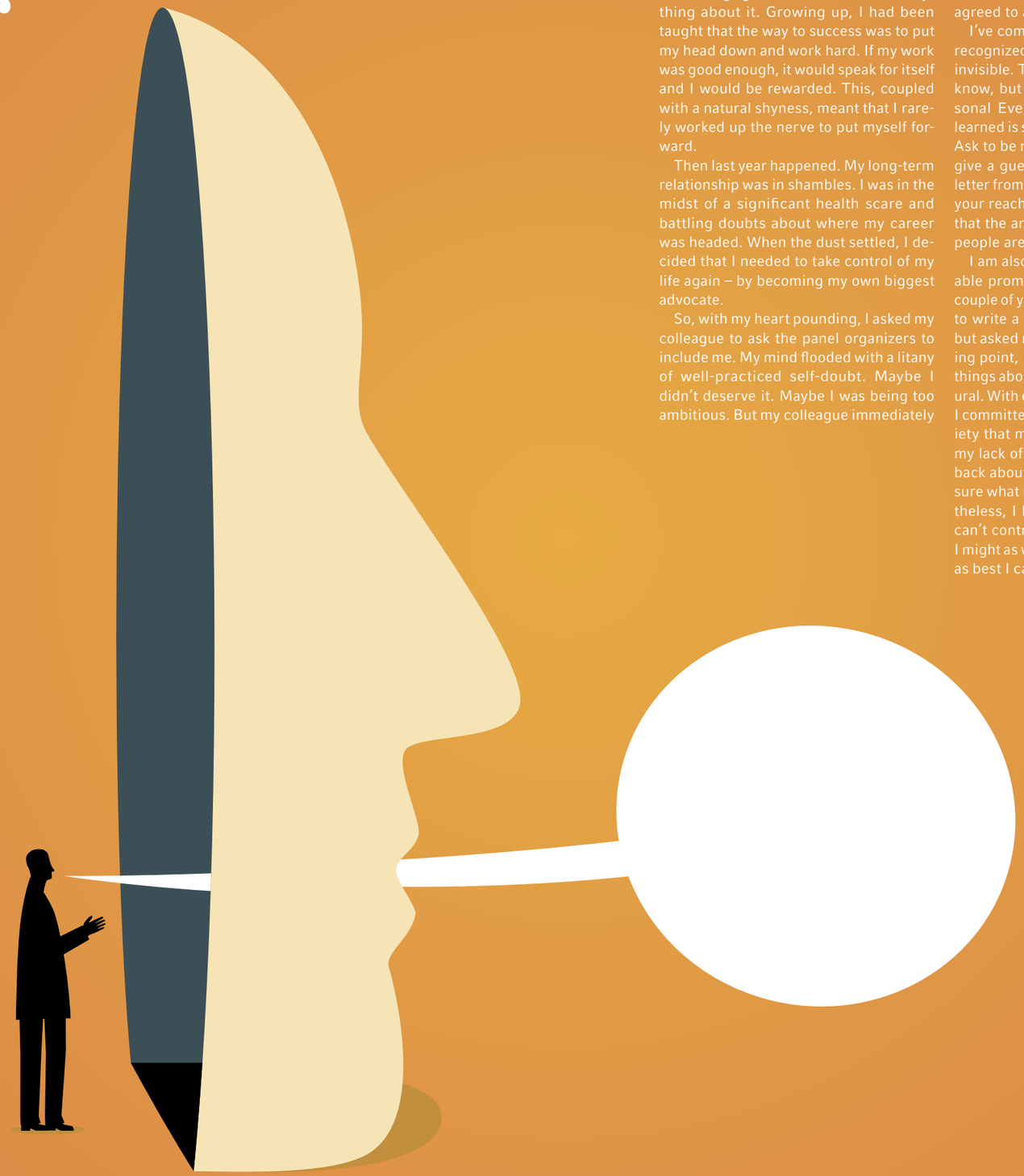
speicherstadt-kaffee.de

A marble "carpet" leads walkers over 27 meters across the Wilhelminen-Brücke in Hafencity. It is intended to remind us of the importance of the Speicherstadt as a transshipment point for oriental carpets. Nowhere else in Europe is there more trade in carpets than here: When laid end to end, the goods will cover an area the size of 16 football fields. Whoever wants to be inspired is in the right place at **"On the Rugs"**: Anna Wahdat, daughter of a long-established Hamburg oriental carpet dealer, shows beautiful oriental and nomadic carpets in her showroom at Sandtorkai.

Am Sandtorkai 26,
20457 Hamburg

www.ontherugs.de

Let Your Stars Shine



A few months ago, one of my fellow graduate students was offered an incredible career-building opportunity. His efforts on a student-led campaign to increase federal funding for basic research had led to an invitation to speak on a conference panel about health research advocacy. He would have a prominent platform to share his work with a large audience, and he would get to meet and network with leaders in the field. It would look great on his CV. I was happy for him, of course; he deserved it. But my feelings were complicated. I had been an equal partner in the campaign. I felt that I deserved the same opportunity. Yet I hadn't been invited, and I wasn't sure why.

Not long ago, I wouldn't have done anything about it. Growing up, I had been taught that the way to success was to put my head down and work hard. If my work was good enough, it would speak for itself and I would be rewarded. This, coupled with a natural shyness, meant that I rarely worked up the nerve to put myself forward.

Then last year happened. My long-term relationship was in shambles. I was in the midst of a significant health scare and battling doubts about where my career was headed. When the dust settled, I decided that I needed to take control of my life again – by becoming my own biggest advocate.

So, with my heart pounding, I asked my colleague to ask the panel organizers to include me. My mind flooded with a litany of well-practiced self-doubt. Maybe I didn't deserve it. Maybe I was being too ambitious. But my colleague immediately contacted the organizers, who quickly agreed to add me to the panel.

I've come to understand that I can't be recognized or rewarded for my work if I'm invisible. This isn't a revolutionary idea, I know, but as an introvert this is my personal Everest. The biggest lesson I've learned is simply to ask for what you want. Ask to be nominated for an award. Ask to give a guest lecture. Ask for a reference letter from that person you think is beyond your reach. The worst that can happen is that the answer is no, but I've found that people are generally happy to oblige.

I am also working to get more comfortable promoting my accomplishments. A couple of years ago, when a mentor agreed to write a recommendation letter for me but asked me to provide a draft as a starting point, I agonized over it. Writing nice things about myself felt completely unnatural. With every complimentary statement I committed to paper came mounting anxiety that my mentor would disapprove of my lack of humility. I never got any feedback about that letter, so I don't know for sure what my mentor thought of it. Nonetheless, I learned an important lesson: I can't control what other people think, so I might as well share my accomplishments as best I can. These days, whenever I ask for a recommendation letter, I offer to provide a draft. I know best how to highlight my skills and accomplishments for a particular application, and it doesn't hurt to offer.

I've also embraced social media as a way to share my accomplishments more widely. I was hesitant at first, worried that I might cross the line from self-promotion to bragging. But when I asked myself whether I was turned off by other scientists sharing their publications, awards, projects and achievements, the answer was clear: nope. In fact, their self-promotion helped me discover amazing work and find new professional connections. Last year, for example, I was intrigued to see two young female scientists promoting their new podcast on Twitter. I commented on their post, suggesting science policy as an episode topic, and they ended up interviewing me on their show! This unique opportunity would never have materialized without a little online self-promotion on both our ends.

I think advocating for myself will always make me a little uncomfortable. But I do plenty of other uncomfortable things to ensure I'm living my best life, like getting flu shots and (ugh) going to the gym. I suppose I can do the same for my career. ■

Vanessa Sung is a PhD student at McGill University in Montreal, Canada, and co-president of the Science and Policy Exchange

Science
AAAS

THE SOURCE

This article was reproduced with the kind permission of the journal "Science", in which this article was first published on July 27, 2018 in the section "Working Life".

Nature in Pictures

The 2019 “Royal Society of Biology” photo competition will produce real talents in photography. Here we present two animalistically good winning motives.

Runner up: Young Photographer of the Year ▸

Lillian Quinn has captured a large herd of zebras crossing the Maasai Mara National Reserve in Kenya. The zebras are hoping to avoid the crocodiles on their way to the other side of the river. They make the trip once a year.

Photographer: Lillian Quinn
Title: The Stampede
Taken: Maasai Mara National Reserve, Kenya

“Capturing Movement” is the theme of this year’s Royal Society of Biology Photography Competition. Life on Earth is constantly changing, and photographers are invited to take a photo of nature in motion. Supported by Eppendorf, the competition has two age categories: 18 and over and under 18s.
www.rsb.org.uk/photocomp

▲ Highly commended: Photographer of the Year

Mudhoppers are very territorial and usually chase away intruders. They are amphibian fish, which means they can leave the water for a long time and survive for several days out of the water. They breathe through the damp lining of their mouth and throat, so they prefer high humidity and are often found in muddy mangrove swamps.

Photographer: Sudhir Gaikward
Title: Territorial Fight
Taken: Sundarban Tiger Reserve, India

eppendorf

Shop Online!

Do You Shop Online?

How about ordering your Eppendorf products online? Place your order in seconds!

Online benefits:

> 24/7 availability
> Redeem your quotations
> Take advantage of special online offers

Special features[1]:

> Access to contract pricing
> Quick order with batch upload
> Check stock availability

[1] May not be available in all countries

www.eppendorf.com/eshop

Eppendorf Online Shops are not available in every country. Please contact your local distributor in case of questions.

Climate neutral
Print product
ClimatePartner.com/10595-2004-1008

AA01 011 320-EN/21.5T/052020