



Alexander von Humboldt  
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# Humboldt kosmos

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Research – Diplomacy – Internationality

## THE FUTURE ON OUR PLATES

Tomorrow's food and how we'll eat it



DEUTSCHE  
VERSION:  
BITTE  
WENDEN

### THE BATTLE AGAINST FAT AND SUGAR

Searching for a drug against  
obesity and diabetes

### THE TASTE OF GERMANY

Humboldtians on  
German food culture



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# OVER THE MOUNTAINS



Photo: A still from a film portrait of Wolfgang Wernsdorfer/Humboldt Foundation

The picture shows me running in the mountains around Grenoble where I lived for 23 years. The city is surrounded by four mountain peaks, ideal terrain for my favourite sport: long-distance mountain running.

I've always taken plenty of exercise, ever since my student days – it's a good counterbalance to studying physics and doing research. Over the years, the types of sport have changed. For a long time, I cycled, but it gradually got too dangerous in the mountains. So, I started to run. That was great until I got to the top of the mountain. Once I was there, I immediately started thinking about the lab again and wanted to get down as quickly as possible. I got the idea of long-distance mountain running from a Ph.D. student I had. Instead of taking the coach like everyone else, he ran all the way to a lab meeting in the mountains. That intrigued me, so I went running with him. And I wasn't even bad considering I'm 15 years older than him. After that, I started training properly, partly because of this ambition tick I have.

Nowadays, I run several races a year. The longest mountain races are the 100 mile trails: 11,000 metres up and down again. It sounds like torture, I know, but running in the mountains is different from running marathons, for example. In marathons, it's only the time that counts. In long-distance mountain running, it's about the energy you

use. Some of the races take days. You have to be very careful how much energy you tank, what you eat and drink and that you get enough rest and sleep. It's best to go about it scientifically: if you know what your own body needs and how it functions you can find the right recipe so that you don't fall into the traps of long-distance mountain running and start getting stomach cramps, or blisters, or losing too much water. Really, it's just like research: you have to seek out the boundaries, get to know them and push them back.

When I'm on a run, I feel as though I'm in a different world. You start running, your body works very hard, and that stimulates the mind. And then you think about all sorts of different stuff. Usually you run the same trails so you see how nature changes with the seasons. I can remember all of my races really well, even the ones I did years ago. Every hour left its mark. This is something really special that I don't experience very often.

*Recorded by* **TERESA HAVLICEK**

**WOLFGANG WERNSDORFER** has been an Alexander von Humboldt Professor at Karlsruhe Institute of Technology (KIT) since 2016. A physicist, he was previously a Directeur de recherche première classe at the Institut NÉEL in Grenoble, France.



Photo: Humboldt Foundation / David Auserhofer



*Dear readers,*

Parts of the world are starving, others are getting ever fatter. How will we satisfy everyone’s hunger in future? How can nutrition help us to stay, or become, healthy? How can we get enough protein without yet more cattle polluting the air with methane and the groundwater with manure – and without clearing great tracts of rainforest for grazing or growing the ingredients for vegan spreads? What can we do to ensure that excess calories do not turn even children into diabetics?

The list of challenges is long and so is the raft of ideas and visions for addressing the future of the food on our plates: from cultured meat and edible insects to high-rise farms, personalised nutrition and food at the push of a button from a 3D printer.

Ideas that used to be the prerogative of science fiction novels are now becoming reality and turning nutrition research into one of the most exciting fields – for industry and start-ups as well. In this edition, we take a look at the various actors and trends.

The rest of this edition also revolves around the topic of nutrition. We feature the research of medical scientist Matthias Tschöp who is working on a drug against obesity. And we ask Humboldtians how they like German food, what vegetable is hidden behind the baffling name “Spongel”, and discover which German dishes our fellows really miss when they return home.

**GEORG SCHOLL**

*Editor in Chief*



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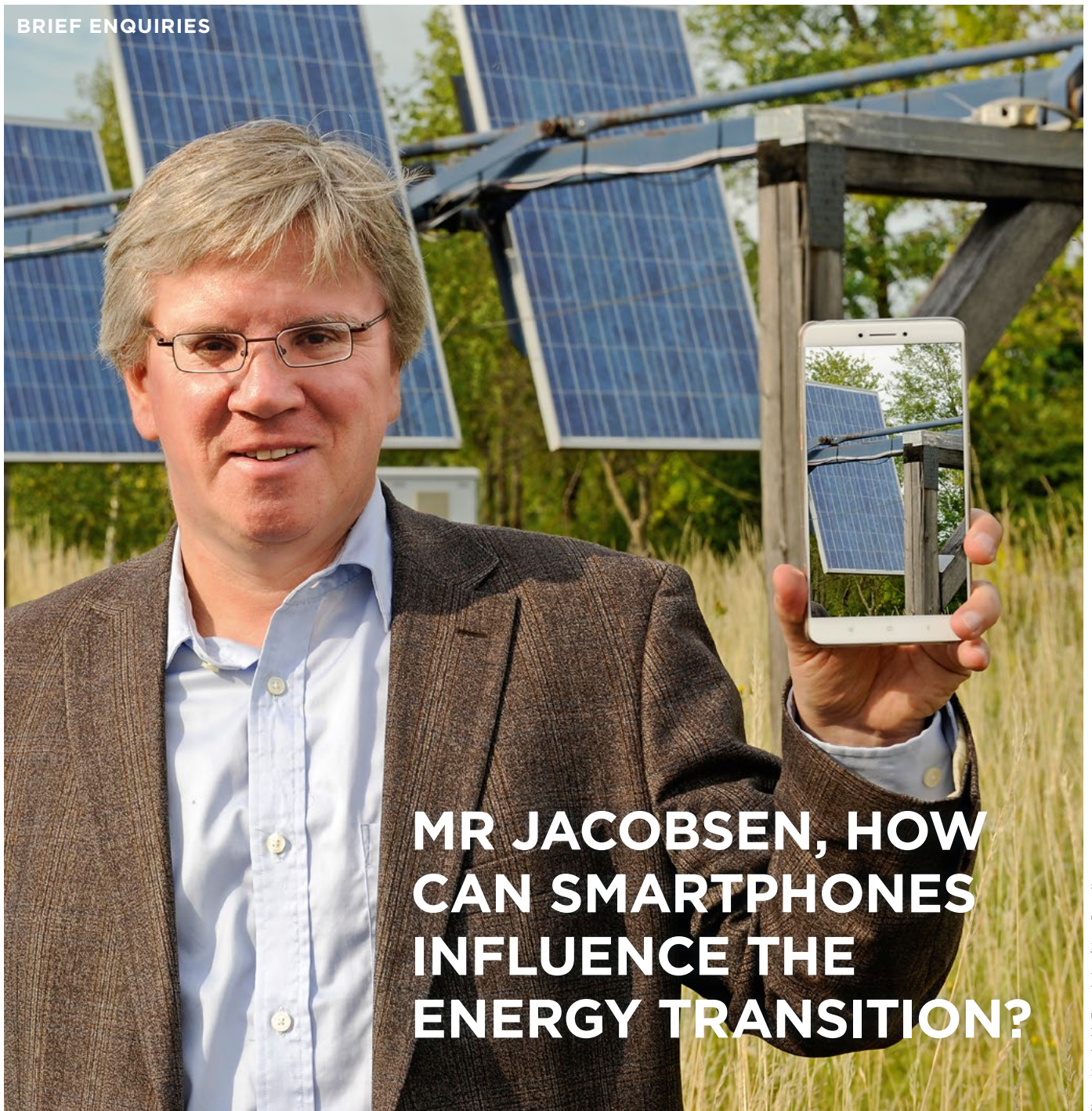


Photo: Humboldt Foundation/Hans Deumling

**Anyone who wants to can take part in Hans-Arno Jacobsen's research project – all you need is a smartphone. Hundreds of volunteers around the world are already busy taking photos of wind turbines, solar plants, transformer stations and power lines. The aim of this crowdsourcing project: a global map of the world's electricity grids.**

With their OpenGridMap app, Jacobsen and his colleague José Rivera have created a planning tool for the energy transition and want to use it to deliver previously missing data on the global electrical infrastructure. "There are hardly any open data on power networks around the world or, if there are, they are not being released," says Jacobsen. The Munich researchers want to change all that.

To do so, they are banking on the enthusiasm of citizen researchers worldwide who are using their smartphones with the OpenGridMap app to take photos of transformer stations and wind turbines and send

them together with their exact locations to the server of the Technical University of Munich. Rivera and Jacobsen then analyse and evaluate the data and upload them onto the digital mapping system OpenStreet-Map. The computer scientists use these data to calculate models which enable them to draw inferences about power consumption, current flow, over- and undercapacity. "You can only plan to remodel power supply if you know precisely where the power lines are and where to find the transformers that do the job of changing high-voltage electricity into low voltage and feeding it into the grid," says Jacobsen. "For this we need an open map of power grids, and everyone can help us make it."

**PROFESSOR DR HANS-ARNO JACOBSEN** is an Alexander von Humboldt Professor at the Technical University of Munich.

*Text* KRISTIN HÜTTMANN





## WHY DO YOU COMPARE MAO AND GANDHI, MS RAMASWAMY?

Photo: Humboldt-Foundation/Dirk Beichert

**The one was a minimalist, wearing just a simple khadi loincloth and sandals, the other presented himself in uniform. In choosing Mahatma Gandhi and Mao Tse-tung, the historian and Asia expert Sumathi Ramaswamy is comparing the two founding fathers of the world's most populated countries: Gandhi, the figurehead of the peace movement in India, and Mao, the strict revolutionary in China.**

Ramaswamy wants to discover how the two of them managed to create images that mobilised millions of people for their respective movements and turned them into heroes. "Even decades after his death, Gandhi is still the most frequently pictured Indian of his time." In collaboration with her Heidelberg colleague Barbara Mittler, she examines historical images of the two men and compares an aspect that has been neglected so far: the aesthetic/artistic appearance of their bodies with a focus on stature and clothing. "I'm also interested

in how their masculinity is portrayed," says Ramaswamy. Taking examples such as Gandhi's salt march and Mao's Yangtze River swim, she investigates how the two figures presented themselves in public. She suspects that "they used these practices to strengthen their leadership position and unite a national community behind them."

The nature of heroism has changed over time, according to Ramaswamy. With social mass media, heroes emerge over night, but are very short-lived. "In Gandhi's and Mao's days, heroism thrived much better. Both of them managed to use the power of images to anchor themselves in their supporters' minds."

**PROFESSOR DR SUMATHI RAMASWAMY** is an Anneliese Maier Research Award Winner, cooperating with Heidelberg University.

Text **NADINE QUERFURTH**



## MR HAICK, WHAT DOES OUR BREATH TELL YOU ABOUT OUR HEALTH?

Photo: Humboldt Foundation / Nathalie Zimmermann

**It is possible to smell disease. This is nothing new, the Greek philosopher Hippocrates already worked on the same hypothesis. But it took more than 2,000 years for science to come up with tangible proof. The Arab-Israeli researcher Hossam Haick has now presented the evidence: he has shown that many diseases have a smell all of their own.**

“The challenge in analysing breath is to create a kind of fingerprint of the breath,” says Haick. “And to differentiate between the components that are normal and the ones that indicate disease.” To do so, Haick and his colleagues use nanosensors made of gold and carbon which trace a certain pattern of volatile organic compounds (VOCs) in human breath. They have managed to identify the breathprints of 17 diseases, including certain early stages of cancer. Based on nano-

technology, Haick has given this electronic nose the moniker “NaNose”. It is already in use in research and Haick hopes his “NaNose” will one day revolutionise the diagnosis of disease.

“Our technology is designed to help detect diseases easily and cheaply and, above all, at a very early stage,” he explains. His ambitious goal is to scale down the technology until it fits into a smartphone. A prototype “sniffphone” has already been built, but it will take years before it reaches market maturity.

Biomedical scientist **PROFESSOR DR HOSSAM HAICK** from Technion - Israel Institute of Technology in Haifa is a Humboldt Research Award Winner cooperating with the Max Planck Institute for Polymer Research in Mainz. *Text* **KRISTIN HÜTTMANN**



# CAN WATER CHANGE SOCIETY, MS MORGAN?



Photo: Humboldt Foundation/Hans Deumling

**One of Ruth Morgan’s childhood memories is of her grandfather watering his garden in a suburb of Perth – such a valuable commodity had to be used before daybreak when the ground was still cool and evaporation slower. Little did the Australian historian know at the time that water would become her primary research topic.**

“Water is life, but its availability is also a measure of social status and a means of social discrimination,” says Morgan, who has specialised in environmental history. In her book “Running Out? Water in Western Australia”, she uses the example of Western Australia to describe the impact of climate change, historical attitudes to the resource water and the concomitant social transformation.

Access to water or the absence thereof has the potential to cause social conflict and exacerbate political and social divisions, Morgan

explains. “In the late 19th century, for example, a lack of personal hygiene led to discrimination and social exclusion, particularly with regard to Australian indigenous peoples,” she comments.

Morgan’s current goal is to find approaches to helping today’s urban planners and city dwellers plan for future water supplies. Even though the Australian government has found ways of dealing with water scarcity, she still urges caution: “Households as well as industrial groups must remain vigilant and use water carefully.”

Environmental historian and historian of science **DR RUTH MORGAN** from Monash University, Clayton, Australia, is a Carl Friedrich von Siemens Research Fellow at the Rachel Carson Center for Environment and Society at LMU Munich. *Text* **NADINE QUERFURTH**



# THE FUTURE ON OUR PLATES

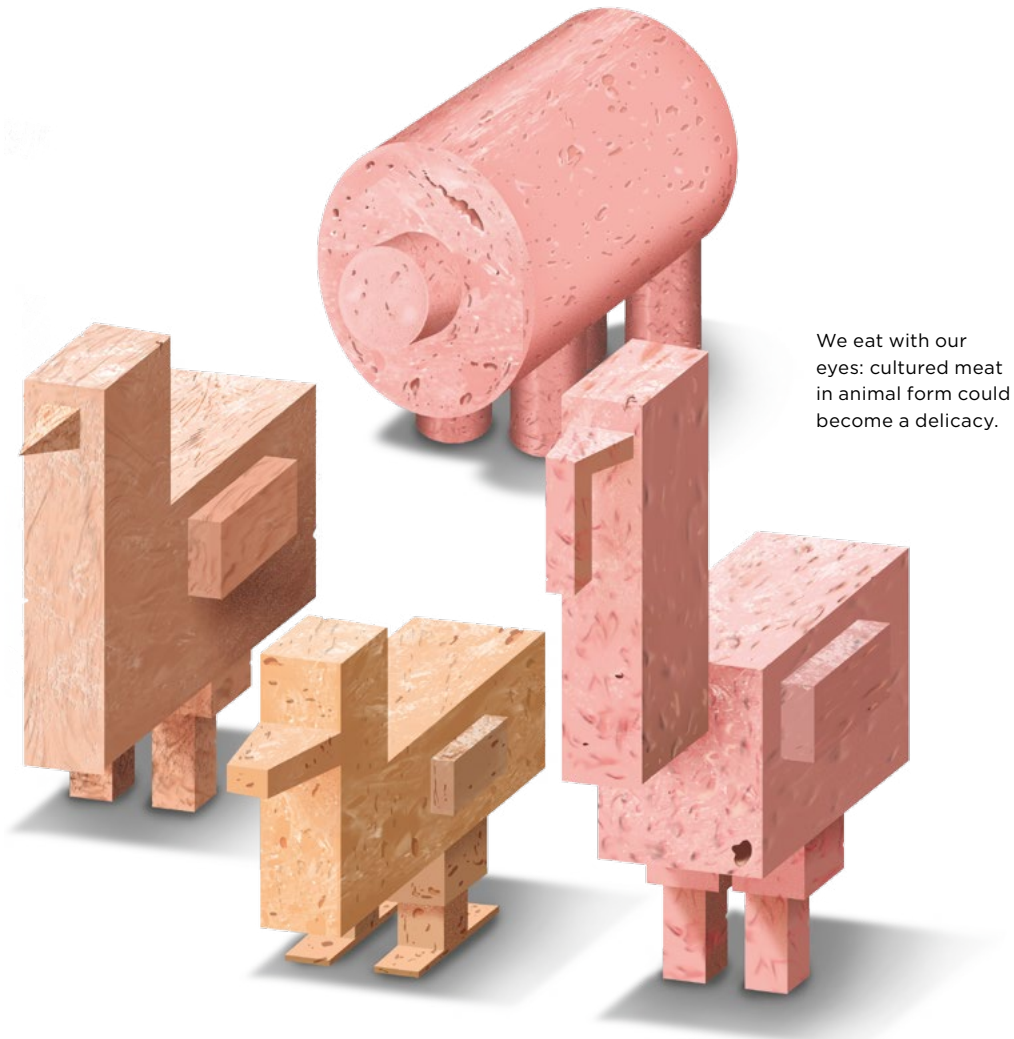
Researchers, food giants and startups – they are all searching for tomorrow’s food. Personalised and tailored to our own genes, ethically irreproachable and environmentally friendly, filling, healthy and profitable. What sounds like trying to square the plate, is supposed to happen soon – because the problems are urgent.

Text **LILO BERG** Illustrations **MIRIAM BAUER**









We eat with our eyes: cultured meat in animal form could become a delicacy.

It smells like meat, looks like meat and, if the test subjects are to be believed, tastes like meat, too. But there is nothing animal about this meatball, it is entirely vegetable. Scientists at Impossible Foods spent five years tinkering with the recipe before they launched their vegan burger in San Francisco in summer 2016. It is soon due to hit the restaurants big time – with the support of Bill Gates, Google and other top-notch investors.

Silicon Valley may have just taken the lead with its plant-based burger but the idea of cultured meat originated in Europe. Back in 2013, the Dutch medical scientist Mark Post produced a rissole, cultivated in a complicated process from the stem cells of cattle, at a cost of 250,000 euros. But with the startup Mosa Meat, he is about to launch a stem cell meatball at an affordable price. According to Post, the production costs have now been reduced to roughly 10 euros a burger. The competition, however, is hot on his heels. With money pumped in by big financial investors, new firms are popping up all over the world and researchers are developing cultured meat patterned on pork and chicken as well.

## MEAT IS MORE THAN JUST A FOODSTUFF, IT'S THE SYMBOL OF A GLOBAL CRISIS.



Meat is more than just a foodstuff, it has become the symbol of a global crisis. Approximately a third of the world's entire land area is currently devoted to meat production. The animals pollute the soil and water with their excretion and accelerate climate change with their emission of greenhouse gases. And although it is known that a big appetite for meat can make you fat and ill, according to the Food and Agriculture Organization of the United Nations, the annual per capita consumption of meat in industrialised countries is an impressive 96 kilos; in poorer countries consumption is growing fast. At the same time, the population is growing, too: United Nations' figures show there are 7.6 billion people living on Earth; by 2050, it will be ten billion and by 2100, more than eleven billion. Everyone wants to satisfy their hunger and feel comfortable. But how can it be done?

### THIRTY-STOUREY HIGH-RISE FARMS

This is a question preoccupying people all over the world. It does not just attract the attention of scientists and clever investors seeking to fill our plates with cultured meat, cultured fish and the like. High-tech prophets are also joining the fray with visions of 30-storey high-rise farms supplying entire mega cities with vegetables and fruit – or scenarios involving 3D printers for our own kitchens with jets dispensing not ink but pureed food – adapted to our personal gene profile and containing everything the body needs. This would not be a million miles from the daily food capsule utopians were predicting a good hundred years ago but which, thankfully, never came about. Instead, the shelves of food in the rich part of the world groan under an amazing abundance of goods and ever more people pay homage to particular dietary regimes.

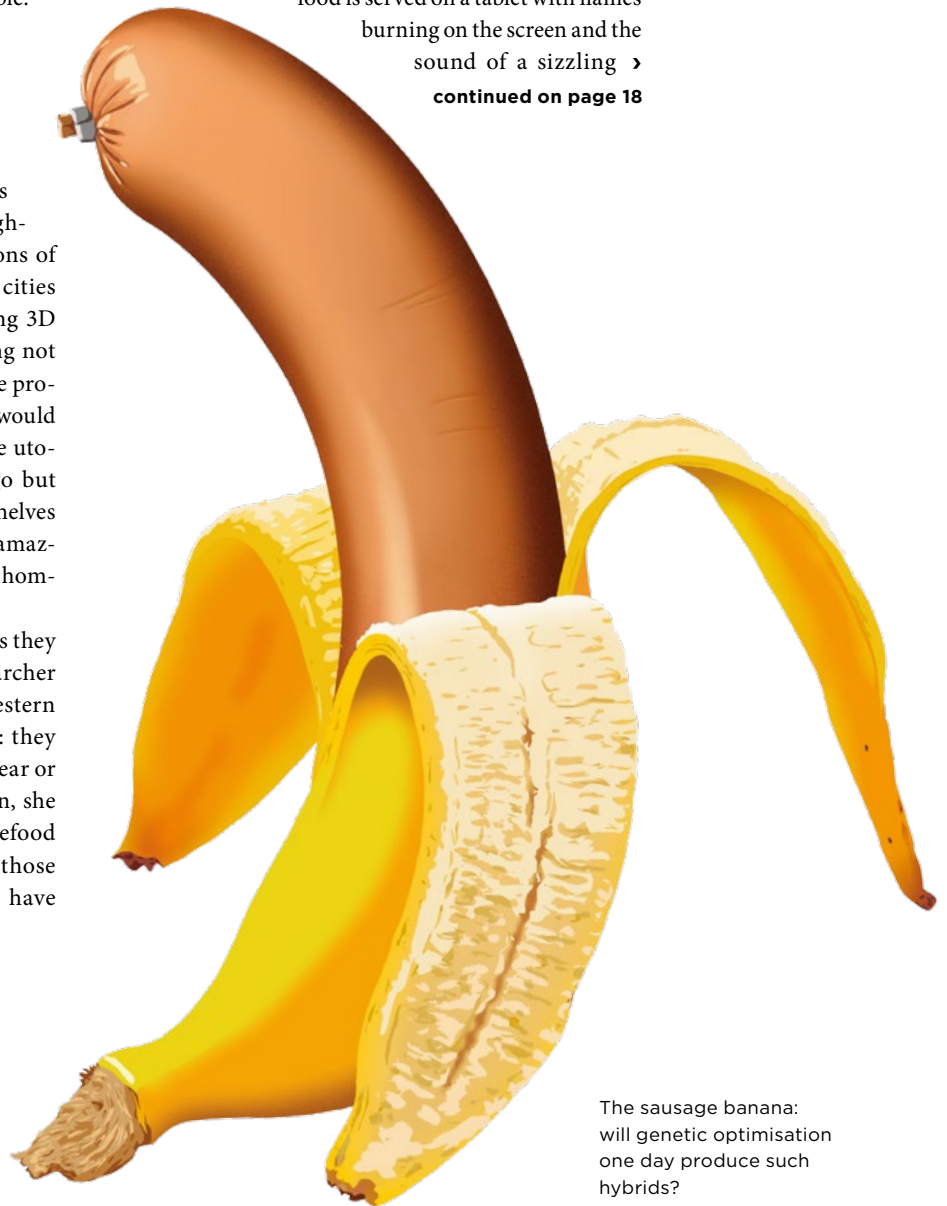
“Never have people talked so much about food as they do today,” says Hannelore Daniel, nutrition researcher at the Technical University of Munich. In our western lands-of-plenty many people have lost their way: they long for the supposedly ideal food world of yesteryear or turn the act of eating into a kind of ersatz religion, she notes. From veganism to the paleo diet, the wholefood boom and superfoods, the field is teeming with those searching for meaning. Daniel's diagnosis: “We have reached the metaphysical stage of nutrition.”

### THE SOUND OF WAVES SPARKS A FANCY FOR FISH

Sensual enjoyment does not have to get forgotten in all of this. How it can be cleverly increased by psychological insights and modern communications technology is described by the British psychology professor Charles Spence in his new book “Gastrophysics: The New Science of Eating”. It has been proven, for example, that fish tastes better if it is accompanied by the gentle sound of waves. “It wouldn't surprise me if the waiters of tomorrow bring us headphones as well,” says Spence, a Friedrich Wilhelm Bessel Research Award Winner who heads the Crossmodal Research Laboratory at the University of Oxford.

Even today, in some restaurants, grilled food is served on a tablet with flames burning on the screen and the sound of a sizzling >

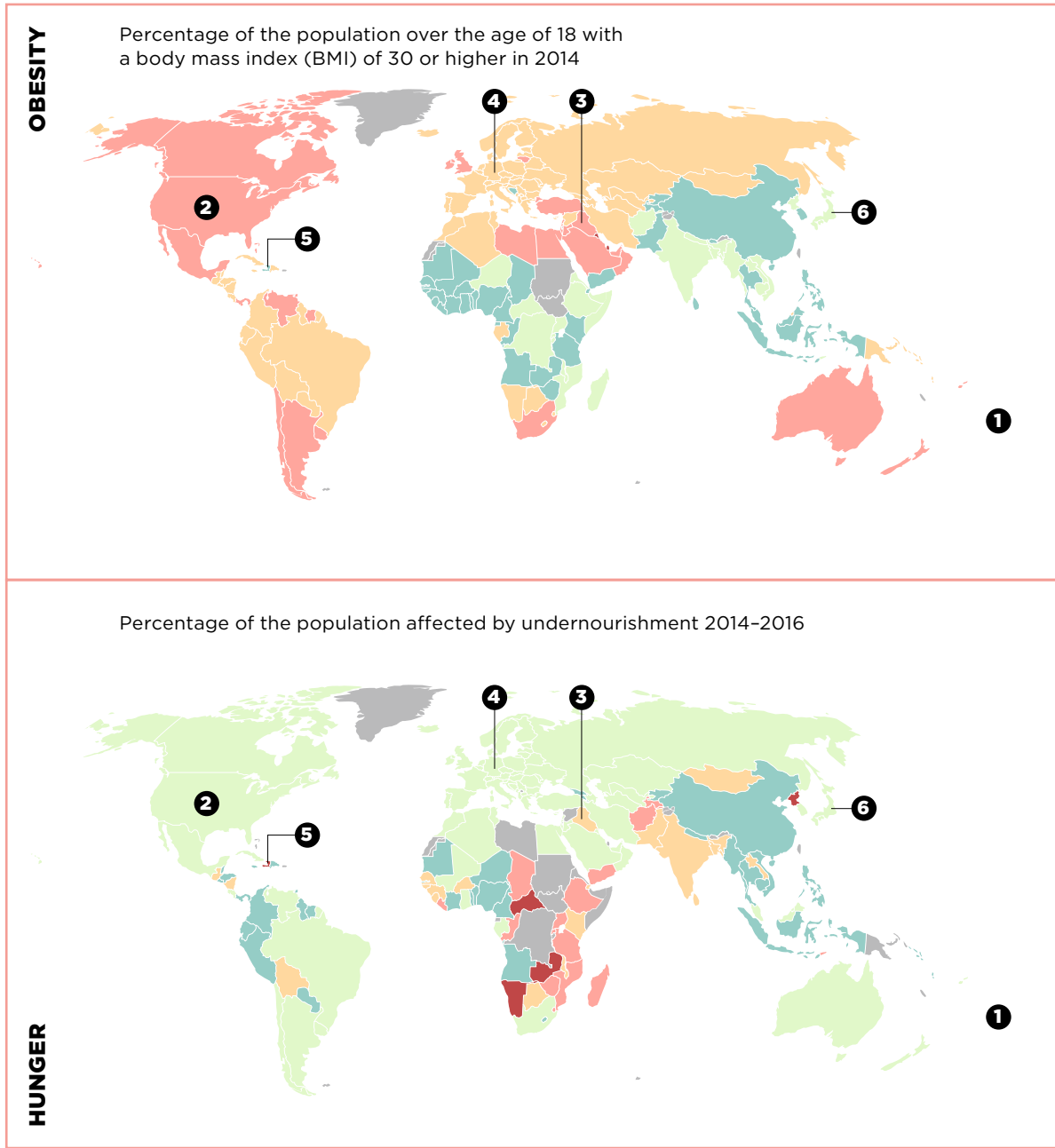
**continued on page 18**



The sausage banana: will genetic optimisation one day produce such hybrids?

# OBESITY AND HUNGER WORLDWIDE

In countries where there are a lot of obese people, are there concomitantly few people who suffer from undernourishment? At first sight, this would seem to be a logical inference. If we directly compare the distribution of obesity and undernourishment, however, it emerges that excess and distress can exist side by side.



Sources: Based on FAO: State of Food Insecurity in the World 2015 (data on undernourishment), WHO: Global Health Observatory: Prevalence of obesity (data on obesity)

The presentation of this map does not imply the expression of any opinion whatsoever concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.

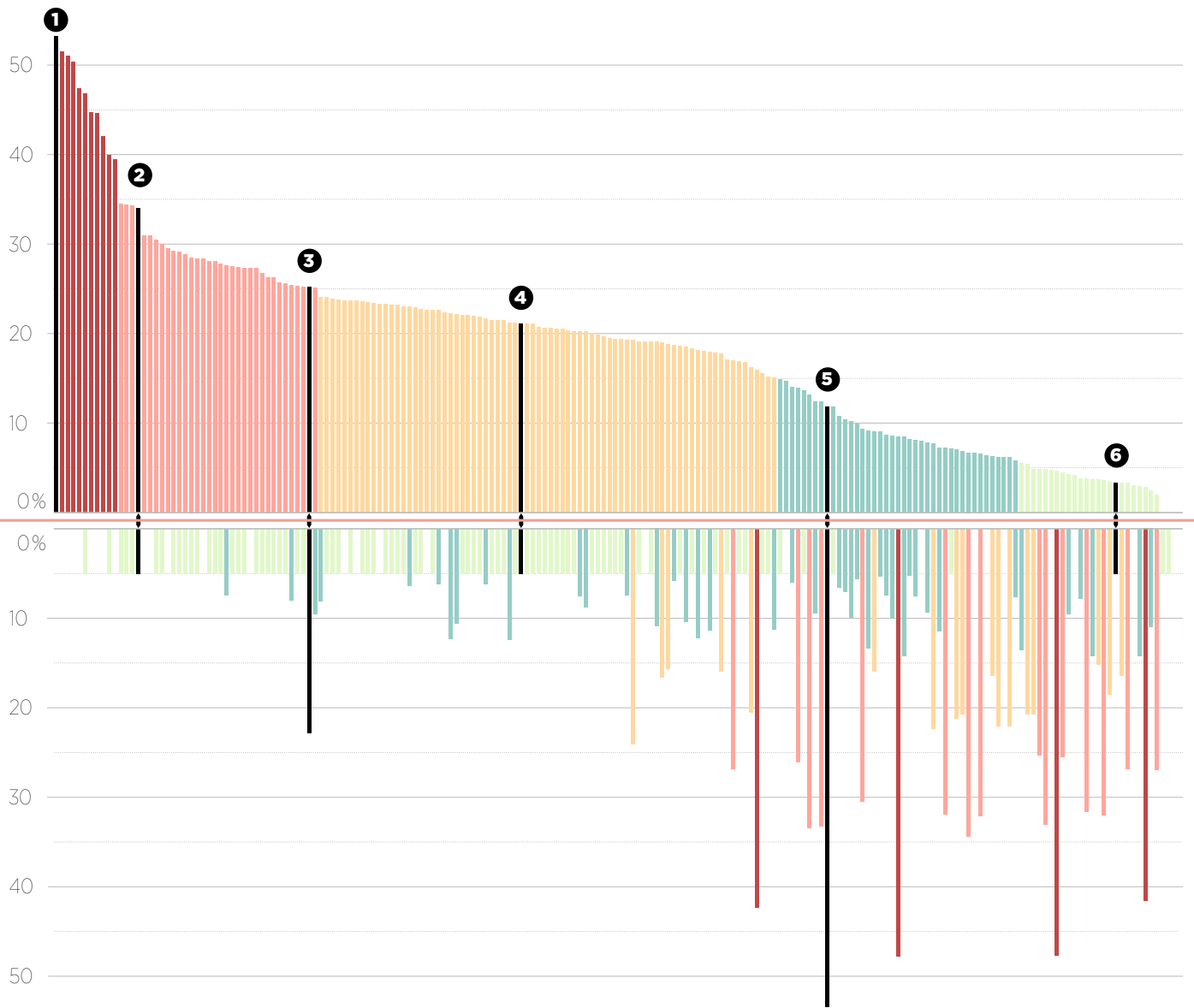
\*There are no precise figures for undernourishment below the 5 per cent threshold.

## Is there a connection between obesity and hunger?

There is no clear pattern to the distribution of hunger and obesity across the globe. Some special cases:

- 1 Cook Islands**  
With an obesity rate of more than 53 per cent, the archipelago is the world leader – closely followed by other Pacific islands like Niue, Nauru and Tonga.
- 2 USA**  
At 34 per cent, the United States has the highest proportion of obese people in the industrialised world.





Where no figures are available, spaces have been left in the bar chart.

### 3 Iraq

Despite war, terror and destruction, the percentage of obese and undernourished people nearly holds the balance: a good 25 per cent as against just under 23 per cent.

### 4 Germany

At 21 per cent, Germany ranges in the mid-field of obesity statistics - whilst hunger is virtually non-existent at under five per cent.

### 5 Haiti

Nowhere else do so many people suffer from undernourishment, although the percentage of people with a BMI above 30 is still nearly 12 per cent.

### 6 Japan

The world's exception: fewer than five per cent suffer from undernourishment, and obesity is also virtually non-existent at just over 3 per cent.



Already off the drawing board: multi-storey farms growing fruit and vegetables in inner cities

wood fire blended in. The experience enraptured many guests, reports Spence, who thinks tablets are likely to become tomorrow's plates. Musical spoons, on the other hand, that do not just transport Indian curry into our mouths but – inaudible for other diners – the sound of sitar music as well, are not likely to catch on. He is also critical of the first 3D food printers for the home: “They’ll end up at the back of the cupboard collecting dust.”

Insect cuisine, by contrast, could be looking ahead to a golden age: “Even in our part of the world, we’ll soon be eating ants, termites, locusts, appetisingly prepared by small specialised firms” – possibly accompanied by the consciousness of consuming ethically irreproachable proteins. “People are spending more and more time thinking about their food,” Charles Spence has observed. He predicts a great future for the sustainability trend.

That is precisely the aim of the philosopher Harald Lemke. The Humboldtian sees himself as a representative





Another far-distant vision: the screw pig – pork in a tube

## “WHEN YOU EAT YOU DON’T JUST FILL YOUR STOMACH, YOU MAKE ALL KINDS OF CONNECTIONS WITH THE WORLD.”

of gastrosophy, a school of thought that studies both the wisdom of eating as well as the political dimension of nutrition. “When you eat,” says the director of the International Gastrosophy Forum in Saalfelden, Austria, “you don’t just fill your stomach, you establish all kinds of connections with the world” – with animal ethics and health as well as with land ownership and climate change. Lemke does not, however, argue for the ethics of renunciation but, rather, for seeing cooking and savouring as a consciously responsible art of living. The gastrosopher is under no illusions: although the number of mindful eaters is growing there will still be plenty of people in future who opt for convenience foods and cheap, factory-farmed meat. “A sustainably managed and just world in which everyone benefits equally from existing resources is probably just a lovely dream.”

Under pressure from a burgeoning population, global resources will have to be increased significantly. Apart from glamorous visions for the future, there are also some sensible ideas that hold considerable promise of success. What they can achieve is demonstrated by the work of the

agricultural scientist and Humboldtian Michael Frei from the Faculty of Agricultural Sciences at the University of Bonn. He conducts research on rice, a staple foodstuff for more than half of humanity. Stress factors such as heat, salt water and high ozone levels in the air have an impact on today’s highly-hybridised varieties, and yields are already dropping noticeably. “We urgently need new varieties which can cope better with increasing environmental pressures,” says Michael Frei, who has already hosted a number of Georg Forster Research Fellows in his team. The Bonn scientist’s record to date is nothing to be ashamed of: in collaboration with growers from Bangladesh, rice hybrids have been produced that could come on the market in a few years’ time. “They not only cope with ozone,” says Frei, “they could even yield up to ten per cent more than previous top varieties.”

# SATISFIED AND HEALTHY: THE MAJOR TRENDS

**VERTICAL FARMING:** By 2050, 70 per cent of us will live in cities, and this is where our food could be grown, too – not on level ground but in multi-storey greenhouses with plants sprouting in artificial culture media on the various levels. The arguments in favour of high-rise farms include low water consumption and proximity to consumers. One of the downsides is the high cost of artificial lighting. Apart from some projects that have already been implemented – such as Aero-Farms in the US city of Newark which largely cultivates greens and herbs – there are numerous design studies for vertical farms all over the world.

**3D FOOD PRINTER:** The first food printers are already on the market. Depending on the device, you can build up pancakes, pizza, pasta, gummy bears or marzipan figures layer by layer – hamburgers and consorts are in the pipeline. The printers are fed by cartridges of dough or pureed foodstuffs. The exact food mass can be individually composed by computer – probably in accordance with personalised nutrition in times to come. For people with chewing and swallowing issues, the 3D printer could soon offer more appetising, need-oriented purées.

**INSECTS:** Crickets, locusts, mealworms and the like are rich in high-grade protein, unsaturated fatty acids, micronutrients and vitamins. In 2013, the UN Food and Agriculture Organization called on people to eat insects, but in many countries they are very hesitant. In the western world, however, increasing amounts of insect flour are being used, particularly for animal feed.

**AQUACULTURE:** Very soon, the bulk of edible fish will be grown on commercial fish farms. Aquaponic farms, where fish and plants are cultivated in a closed-loop nutrient cycle, will become more common. And the use of wild fish to produce the oil that feeds aquacultures could become largely unnecessary in future – thanks to ersatz oil derived from algae.

**GENE OPTIMISATION:** New molecular biological procedures that facilitate the precise removal or modification of genetic building blocks are establishing themselves more and more in plant research and hybridisation. Unlike classic genetic engineering, which is contentious in the food sector, they do not involve introducing “foreign” genes. One example is the CRISPR/Cas method: plants hybridised in this way are usually indistinguishable from naturally or traditionally cultivated plants.

**PERSONALISED NUTRITION:** People respond differently to food, and what is good for Peter may be bad for Paul. How these differing metabolic reactions come about and the role played by our genes is the subject of nutrigenomics. On this basis, scientists worldwide are trying to develop practical strategies for personalised healthy nutrition. The idea is that it could be used to prevent nutrition-related diseases like type 2 diabetes and generally contribute to an optimum sense of well-being. Given the complexity of connections within the organism, however, critics doubt whether such plans could be implemented.

**CULTURED MEAT:** Currently, there are two types: meat cultured from animal stem cells in the lab and vegetarian varieties. In addition to ingredients like soya, wheat, coconut oil and potatoes, the latter contain the blood pigment haemoglobin – genetically modified in yeast – that is responsible for the meaty texture and colour. At present, test tube meat is only available in the form of mince as it is still technically impossible to produce joints or steak.





Insect cuisine: appetising creepy-crawlies are gaining ground worldwide, experts say.

Having enough to eat is one thing, eating properly is another. But why are some foodstuffs better for some people than for others? This is the question food chemist Thomas Henle of TU Dresden is investigating. “So far, we know far too little about the fate of food in our bodies, especially from a chemical point of view,” says the scientist, a Humboldt host who often mentors Foundation fellows at his institute. In his research, Henle concentrates on the activities of intestinal bacteria and their metabolic products in degrading cooked food. He hopes to be able to identify defects in the digestive process and starting points for therapies. “Perhaps we’ll even be able to develop personalised intestinal diets for nutrition-related diseases,” says the Dresden scientist.

#### **TAILORED MEALS ARE THE FUTURE**

Hannelore Daniel, the Munich biochemist, is putting her money on a different individualisation strategy: “The future is personalised nutrition that takes account of the interplay between food, metabolism and genes.” International food giants are already pushing hard in this direc-

## **HAVING ENOUGH TO EAT IS ONE THING, EATING PROPERLY IS ANOTHER.**

tion, according to Daniel. Nestlé, for example, has declared personalised nutrition to be one of its corporate goals. In autumn 2016, the American soup producer Campbell earmarked 32 million dollars to invest in the Silicon Valley startup Habit. The Californians design individual meal plans based on a genetic self-check and are looking to deliver ever more tailored meals in future.

Whilst food innovation in the United States is booming, the same cannot be said of the food industry in Germany, which is characterised by small and medium-sized >

**TODAY, TEN TIMES MORE RISK CAPITAL FLOWS INTO THE US AGRI-FOOD SECTOR THAN IT DID JUST FIVE YEARS AGO.**



Will we soon be growing our own personalised food pills?

businesses. Innovation expenditure is even dropping slightly (see diagram on page 23) and was recently 1.3 per cent of the entire sector’s turnover. By comparison: in the electrical industry, the share was 10.4 per cent.

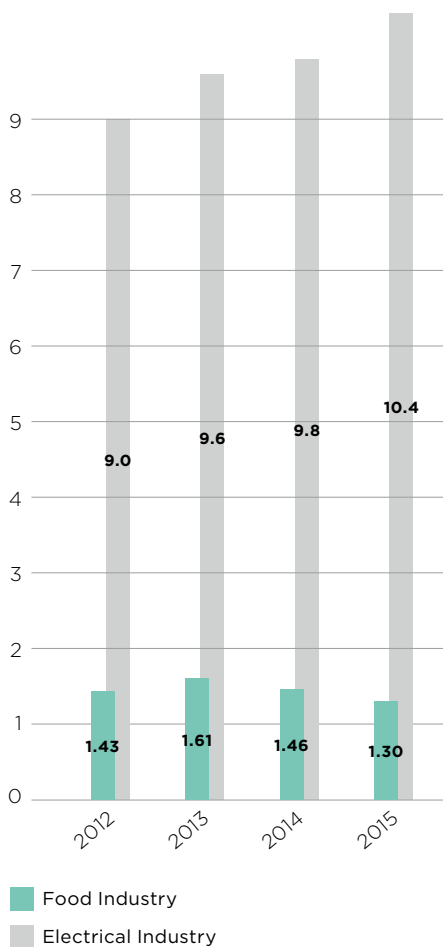
Hannelore Daniel thinks it is high time for a turnaround, which should be ushered in by a significant upgrading of nutritional science. “We need large-scale studies, for example, that can prove the health impact of certain diets in comparison with control groups.”

Still, at least at European level, there has been some movement in nutrition research. After completing the EU project Food4Me, which created the basis for research into personalised nutrition, a 1.6 billion euro innovation programme called EIT Food is being launched for the food sector involving 50 universities, companies and research centres across Europe. “We want to develop new food products for personalised, healthy eating that also take account of the needs of an ageing population,” says Jochen Weiss from the University of Hohenheim, one of the founding directors of EIT Food. Now that investors in the United States have discovered the agri-food sector, roughly ten



### Innovation intensity

Innovation expenditure of sector turnover in Germany (in per cent)



Whilst the electrical industry in Germany increased its investment in developing and implementing product and process innovations to 10.4 per cent of sector turnover between 2012 and 2015, at 1.3 per cent, innovation expenditure by the German food industry was significantly lower – and even dropped slightly.

Source: Centre for European Economic Research (ZEW), Sector Reports on Innovation 2016 – Food, Drink and Tobacco Industry, and Electrical Industry

## FOOD DREAMS

### A brief history of food utopias

Milk and honey flow through the valleys, the houses are made of gingerbread and roasted birds fly through the air: in the land-of-plenty, there is an abundance of everything and no-one has to work. For centuries, fairy tales and sagas have told of this paradisiacal place. Certain motifs from the land of plenty utopia can even be found in the works of classical authors like Herodotus and Lucian.

Fairy tales revolving around hunger, such as the Brothers Grimm story of sweet millet porridge, bear witness to the privations and dreams of earlier generations. Too often, there was not enough to eat and even in Europe, hunger was ubiquitous.

In his 500-year-old novel “Utopia”, the British humanist Thomas More presents his vision of a perfect society. On the fabled island of Utopia, there is always plenty for everyone. The inhabitants eat and drink to stay healthy, without indulging extravagantly.

The idea of a food capsule full of nutrients has been around since the end of the 19th century. The US suffragette Mary Elizabeth Lease promoted it as a way of freeing women from the shackles of cooking. A year later, the French chemist Marcelin Berthelot formulated his vision for the year 2000: there would only be synthetic food, he said – and speculated about beefsteak in tablet form.

The food of the future would be meat-free was the prediction of science fiction writers in the 20th century. Their tables were decked with artificial proteins, freeze-dried space food, sea weed biscuits and algae in bizarre forms. And Aldous Huxley’s “Brave New World” even features synthetic meat. The novel appeared in 1932.

times as much risk capital is flowing into this area today, as compared to five years ago. “We have to reckon with a wave of American startups that will put enormous pressure on established companies in Germany and Europe,” says Jochen Weiss. EIT wants something up its sleeve to set against this, such as establishing 350 startups of its own.

Cultured meat and insect snacks, high-rise farms and pizza printers are probably just the beginning. In the coming years, we will be surprised by a lot of new ideas. The world certainly needs them.

# THE FIGHT AGAINST OBESITY AND DIABETES

The number of overweight people in the world is increasing rapidly and these individuals are at greater risk of developing a raft of associated diseases like obesity, diabetes and cardiovascular disorders. The outlook is bleak because these widespread diseases pose enormous problems for our society. The Munich physician Matthias Tschöp wants to put an end to the obesity epidemic and is searching for a drug to curb our voracious appetite and improve our metabolism.

*Text* KRISTIN HÜTTMANN

**T**ime is short for one man's big mission: Matthias Tschöp wants to heal pathological obesity and diabetes – with a simple pill or injection. The Munich medical researcher is one of the world's most sought-after specialists in this field, his working day packed with lectures, expert committees and team meetings. Tschöp's goal is ambitious given that the two diseases he has specialised in, obesity and diabetes, are turning into an ever-greater challenge to world health. "Nearly every tenth German has diabetes or will have," he says. In Germany alone, 6.7 million people suffer from diabetes and 300,000 new cases are registered every year. The biggest risk factors include excess weight, lack of movement and stress.

So exactly what role does weight play in the development of diabetes? Is it enough just to eat less and move more? Can our behaviour change anything? Or is the answer to be found in our genes, in our brain? These are the questions Tschöp looks to answer, combining fundamental research with the search for drugs, because the 50-year-old does not merely want to understand the mechanisms behind obesity and diabetes but to develop drugs to heal them as well.


And who better than Tschöp, a man who has experienced many different perspectives? His own professional biography started in Munich where he was a male nurse

and mountain rescue emergency doctor. Having worked in multiple hospitals, at distinguished research institutes and for pharmaceutical companies around the world, many career stages later saw him back in Munich as the holder of an Alexander von Humboldt Professorship. Awarded in 2012, it was the first time the honour had been granted to a physician. Tschöp heads the Institute for Diabetes and Obesity at the German Research Centre for Environmental Health, Helmholtz Zentrum München, and holds the Chair of the Department of Metabolic Diseases at the Technical University of Munich – which does not leave him much scope for hands-on lab work. "Of course, nowadays, I'm not the one standing in the lab testing the active ingredients and pipetting the substances," he says. But Tschöp has lost nothing of his passion for the researcher's life with its routine toil and euphoric moments. Perhaps one of the secrets of his success: "It's bringing together different individual perspectives in a team that helps us to solve problems."

## NUMEROUS AWARDS AND HONOURS

More than 300 entries grace his scientific publication list, he has received numerous awards and honours for his work, he holds lectures and appears on television. There is little evidence of any glamour in his study at Garching Business Park, near Munich. Monitors, simple furni- ➤



A portrait of Professor Dr Matthias Tschöp, a middle-aged man with brown hair and a light beard, wearing a blue shirt and a dark blue blazer. He is smiling slightly and looking towards the camera. The background is a plain, light-colored wall.

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**PROFESSOR DR MATTHIAS TSCHÖP**

is a world authority on diabetes research. The medical researcher spent ten years working in the United States, finally holding the Arthur Russell Morgan Chair of Medicine at the University of Cincinnati, Ohio. In 2012, he was awarded an Alexander von Humboldt Professorship and is now back in Germany heading the Institute for Diabetes and Obesity at the German Research Centre for Environmental Health, Helmholtz Zentrum München, and holding the Chair of the Department of Metabolic Diseases at the Technical University of Munich.

ture, white walls. A view through the window of the green heathland to the north of Munich. No plants, no clutter to distract one or demand attention – nothing to gather dust.

At Helmholtz Zentrum München, Tschöp is surrounded by a team of experts from the most diverse disciplines: physicians, cancer and brain researchers, geneticists and cell biologists – they are all searching for the causes of excess weight, obesity and diabetes because when people's weight and blood sugar levels go haywire, there are many contributory factors. Sadly, the solution is not usually a simple case of eating less and moving more, especially as not everyone with love handles gets diabetes and not every diabetic is overweight. And whilst some people only have to look at a piece of cake to put on weight, others can indulge without gaining a gram.

### THE ROLE OF HORMONES

This, of course, has a lot to do with our DNA. There is a certain gene, for example, that is responsible for producing the hormone leptin, which is secreted by fat cells and inhibits the appetite. Some people, however, do not have the leptin gene. "Patients like that don't stand a chance," says Tschöp. "The strongest will in the world won't help them eat less." Monogenetic causes like this are, however, relatively unusual; they tend to be polygenetic. "We carry a number of gene mutations around with us. Individually, they are not such a problem, but if they come together and are combined with environmental factors they can lead to diseases like diabetes."

Researchers are also devoting ever more attention to the role of epigenetics. Environmental factors, movement, nutrition and stress influence which parts of the genetic information coded in our DNA are read in building proteins and which are not. They thus determine which chemical messengers, enzymes and hormones circulate around our bodies. These mechanisms can even be inherited because an immoderate lifestyle and the diseases it engenders alter our DNA – and can be passed on to our children epigenetically.

Tschöp and his team are particularly interested in the signal paths between the brain and our metabolic organs since the brain constantly absorbs information, nutrients

and hormones from the stomach, intestines and liver via the sugar and fat content in the blood, for instance, or via the amount of insulin secreted by the pancreas. It can respond to all these cues and send signals to the organs, such as the ones controlling our appetite.

Scientists have now identified many of the hormones that communicate with the brain and other organs and regulate the sugar and fat metabolism. Tschöp and his team, for example, elucidated the function of the hunger hormone ghrelin. Our bodies produce this molecule in the



**“OUR VISION IS  
TO FIND THE RIGHT  
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Photos: Helmholtz Zentrum München

Not much time left for pipetting cell cultures at the clean bench or taking measurements of tissue and cell cultures – medical researcher Matthias Tschöp is a globally sought-after expert.

stomach lining and pancreas and it is activated by our diet. It functions like a kind of fat sensor. Ghrelin informs the brain about the number of calories on offer and gives the signal for launching energy-consuming processes such as the creation of new proteins and growth mechanisms.

A host of other hormone molecules also originate in the gastrointestinal tract. “Unfortunately, we don’t yet know which of these molecules are the decisive ones,” says Tschöp, “otherwise we could trick the brain into thinking it had eaten enough.” And start losing excess weight. Surgeons already achieve much the same with a gastric bypass. Shortly after the operation, the patient’s blood sugar level returns to normal. Triggered by the surgery, the gastrointestinal tract apparently sends certain chemical messengers to the brain signalling satiation.

#### **SETTING THE BRAIN TO “FULL”**

Tschöp and his team want to find a less invasive way of outsmarting the brain, such as an anti-obesity drug, and they have already taken one crucial step on the way to developing such a substance. “We managed to integrate several of these gastrointestinal hormones into a single

molecule.” This hormone molecule acts as a kind of master key to several docking stations in various organs as well as the brain. It can re-set the processes governing appetite. According to Tschöp, it basically works like a contraceptive pill, which makes the female body believe it is pregnant. The slimming pill sets the brain to “full” even if there is not much in the gastrointestinal tract. Experiments with mice have shown that it works: they ate much less even though the researchers put them on a McDonald’s diet. “We are now doing clinical studies on these substances and hope we’ll soon know how well they function in humans,” says Tschöp.

Meanwhile, he is already thinking about the next stage: not everyone is the same and every diabetic has quite different health issues. “So, our vision is to find the right drug for the right patient, a kind of personalised metabolism medicine,” he explains.

After all, Tschöp never loses sight of his mission: “Diabetes and obesity are two of the big widespread diseases and a threat to our society,” he says. “We mustn’t lose any time in developing effective, safe therapies and new drugs tailored to the individual patient.”

# THE TASTE OF GERMANY

Why are there so many vegans here in Germany when they have such great sausages? Which specialities should be marketed in Brazil, too? And why do Germans throw away so much food? Humboldtians report on their experiences with German eating culture.

Text **LILLO BERG** Illustrations **MIRIAM BAUER**

## WHY SUCH SMALL PORTIONS?

### CHENG YU, CHINA

It's lunchtime. Four young business people are sitting at a table sharing a sandwich. I've never seen anything like it in Hong Kong, where I come from, but in Berlin it's quite usual. Why do Germans eat such miniscule portions at lunchtime? Don't they know anything about enjoyment? Are they afraid of a post-prandial slump? I know it well: it kicks in after a big meal about 3 o'clock in the afternoon and makes you very sleepy. That never happens to me in Berlin. At best, I just look longingly at all the restaurants with cuisine from every conceivable country, or at my favourite chiller cabinet in the supermarket. There you can find the world's best sau-

sages. Lots of young Germans couldn't care less – they're vegans and don't eat any animal products at all. But how can you make stuffed dumplings without eggs? I tried to make some recently and must say they weren't what I'd call typically Chinese.

**CHENG YU (32)** is a German Chancellor Fellow at the Social Impact Lab in Berlin.





# MUSHROOM-HUNTING

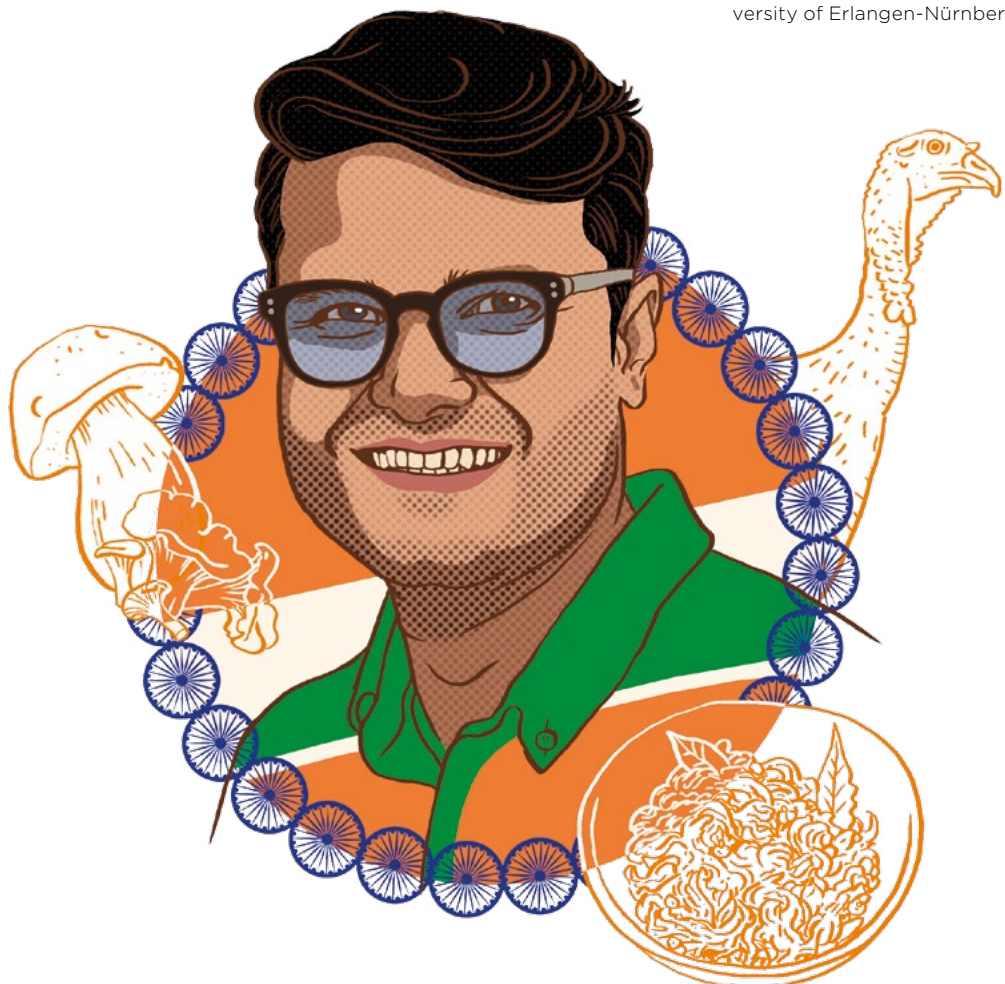
## JAY PATANKAR, INDIA

Chanterelles, porcinis, bay boletes – Erlangen is turning me into a mushroom gourmet. At home in India I wouldn't touch stuff growing in the wild, but in restaurants here I love choosing mushroom dishes. My wife has even bought a guide to identifying mushrooms and our two children are looking forward to mushroom-hunting in autumn. I'm also amused to note that my prejudices about German food are gradually dissolving. I had expected sauerkraut, potatoes and pork in Germany and the prospect made me shudder. But now I can hardly get enough of

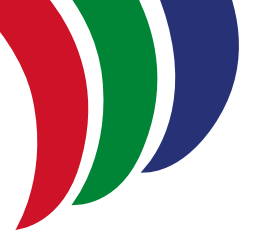


all the good things like wholegrain bread, turkey and wheat beer. I've even found a liking for sauerkraut, especially when it's served with juniper berries. Followed, please, by one of those only slightly sweetened desserts like Bavarian cream, rhubarb cake or apple strudel. Indian desserts? I now find them much too sweet.

Molecular biologist **DR JAY PATANKAR (34)** is a Humboldt Research Fellow at the University of Erlangen-Nürnberg.



# UNBEATABLE PRICES



## ADAM CEESAY, THE GAMBIA



It's incredible what you can do with potatoes! From home, I knew chips and mash but it was only in Bremen that I encountered potato cakes, croquettes, gratin, and potato salad and soup. My German neighbour recently gave me a potato cook book and I've already tried out

some of the recipes. I cook nearly every day, usually a rice dish with fish, which is typical in Gambia. I can buy all the ingredients in my own part of town – at amazingly low prices: in Gambia, I'd easily have to pay five times as much. What I really love is the fantastic choice at German cheese counters. But I am genuinely surprised about table manners: lots of people eat pizza with their hands, for example, even on official occasions. Where I come from we always use a knife and fork.

**DR ADAM CEESAY (33)** is an International Climate Protection Fellow at the Leibniz Centre for Tropical Marine Research in Bremen.

# WHAT ON EARTH IS "SPONGEL"?



## JOHN HENRY LEHMAN, USA

Both my parents have German roots. I've always known fried potatoes, sausages and apple cake – and I love them. But what on earth is "Spongel"? It was the middle of spring and I had just arrived in Berlin. Every day, this peculiar word was chalked up on the menu of my favourite Italian restaurant. In broken German, I asked what it meant and looked it up in the dictionary – in vain.

Eventually, I ordered a portion and discovered it was asparagus, "Spargel". After that, I frequently ordered it, preferably with melted butter, and followed by a strawberry dessert. At lunch-time, I liked to go to the canteen of the PTB, the National Metrology Institute of Germany, where I was developing a light detector for climate research. Of course, it wasn't a Michelin restaurant,

and you should definitely give the junket a miss, but the cooks really did their best, and I thought it was great to have a canteen in the first place. American research institutes hardly ever have their own.

Between 2014 and 2016, physicist **DR JOHN HENRY LEHMAN (54)** spent nine months in Berlin as a Humboldt Research Fellow.







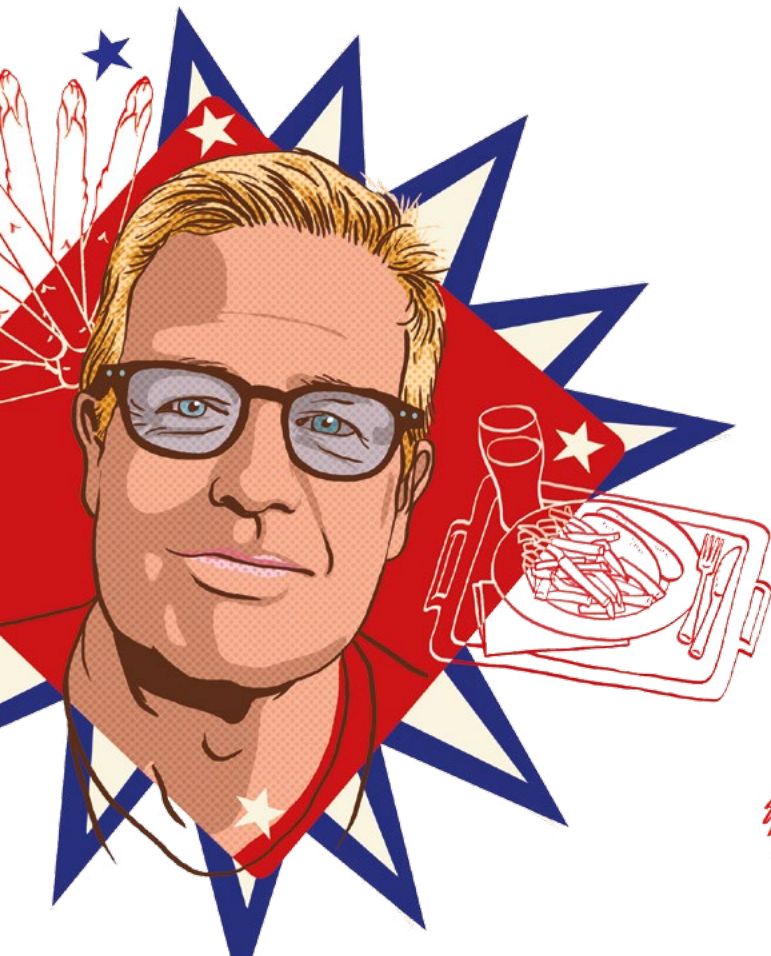
## BREAD, BERRIES, BEER

### SIMONE NUNES BRANDÃO, BRAZIL

Sitting outside with friends, a glass of wheat beer in front of me, munching a roll stuffed with a bratwurst – that’s how good summer in Germany can be. People are happier than at other times, friendlier and more relaxed. You can believe me; after all, I spent ten years in Ger-

many. I’ve now been back in Brazil for the last four years. What epicurean delights do I miss? Above all, the delicious wholemeal bread, raspberries, blueberries, apple spritzer, all the great types of beer, and being able to buy organic products on every corner. Sadly, Germans throw away a lot of food the minute it isn’t so fresh. They can afford to do so because food is relatively cheap. I now have to pay considerably more for my beloved Swiss chocolate. But once a month, it’s a must.

Marine biologist **DR SIMONE NUNES BRANDÃO (41)** was a Humboldt Research Fellow in Hamburg and Wilhelmshaven from 2010 to 2012.







Federal President Frank-Walter Steinmeier and the President of the Humboldt Foundation Helmut Schwarz at the reception for Humboldtians in the gardens of Bellevue Palace

Photo: Humboldt Foundation / David Ausserhofer

## ANNUAL MEETING

# New Federal President meets Humboldtians

In June, more than 570 Humboldtians attended the Humboldt Foundation's Annual Meeting in Berlin. During the reception in the grounds of Bellevue Palace, the new President of the Federal Republic Frank-Walter Steinmeier welcomed researchers and their families from 79 countries. "I am honoured to be able to continue the tradition of these encounters with you in this office."

Steinmeier emphasised the role of science in contemporary public debate: on the one hand, the need for knowledge was growing, at the same time, "rejecting knowledge and reason, badmouthing expert advice" were becoming "ever louder and crasser". One should "not allow the willingness to compromise, to listen and to discuss dispassionately to get lost," Steinmeier continued. He encouraged Humboldtians as well as the entire German science landscape to enter more into conversation with the public: "When the social climate becomes stifling, that's when we need a breath of fresh air from the universities." The President of the Humboldt Foundation Helmut Schwarz

also encouraged Humboldtians to take every opportunity to speak out publicly about what scientists do and thus counter anti-science tendencies. "It should go without saying that in a complex, globally-connected world we do not only need sound, expert analysis, but critical thinking and independence as well," said Schwarz in his opening address at TU Berlin. "The better the freedom of science as well as the freedom of opinion and the press are protected, the better are the conditions under which science can thrive."

In the course of the meeting, Federal President Steinmeier bestowed the Philipp Franz von Siebold Award for special services to German-Japanese exchange on the Japanese philosopher Hiroshi Abe. The Humboldt Alumni Award was presented to the Humboldtians Arkin Olgar, Turkey, Matthias Fritsch, Canada, Sergei Levchenko, Belarus, Aderemi Raji-Oyelade, Nigeria, and Athina Sioupi, Greece, for their initiatives to promote academic and cultural ties between Germany and their own countries.

## More support for researchers at risk

The Humboldt Foundation has expanded its programme for persecuted researchers. In the third round of the Philipp Schwartz Initiative, 41 additional universities and research institutions were selected this summer to host endangered researchers from abroad with the help of this programme.

Funding is being granted for a total of 56 researchers who are seeking safe haven in Germany because they are under threat of war or persecution in their own countries. As of August 2017, they have become Philipp Schwartz Fellows and are spending the next two years conducting their research at the institutions selected. This will nearly double the number of funding-recipients: so far, 68 fellows have been sponsored by the Philipp Schwartz Initiative; the new selection round brings the total up to over 120. Most of the fellows come from Turkey, Syria, Iraq and Yemen.

The programme is being expanded thanks to support from Germany's political sector and private foundations. Funding from the Federal Foreign Office has been supplemented by grants from the Alfried Krupp von Bohlen und



Halbach Foundation, the Fritz Thyssen Foundation, the Gerda Henkel Foundation, the Klaus Tschira Foundation, the Robert Bosch Foundation, the Stifterverband and the Stiftung Mercator. Most recently, the American Andrew W. Mellon Foundation donated 1.05 million dollars which have already been used in the third round to grant additional fellowships to researchers in the humanities and social sciences. The Humboldt Foundation aims to continue the programme beyond the third round.

Visit [www.philipp-schwartz-initiative.de](http://www.philipp-schwartz-initiative.de) for further information on the initiative, the partners and the name-giver.

### AWARD CEREMONY

## New Humboldt Professors honoured

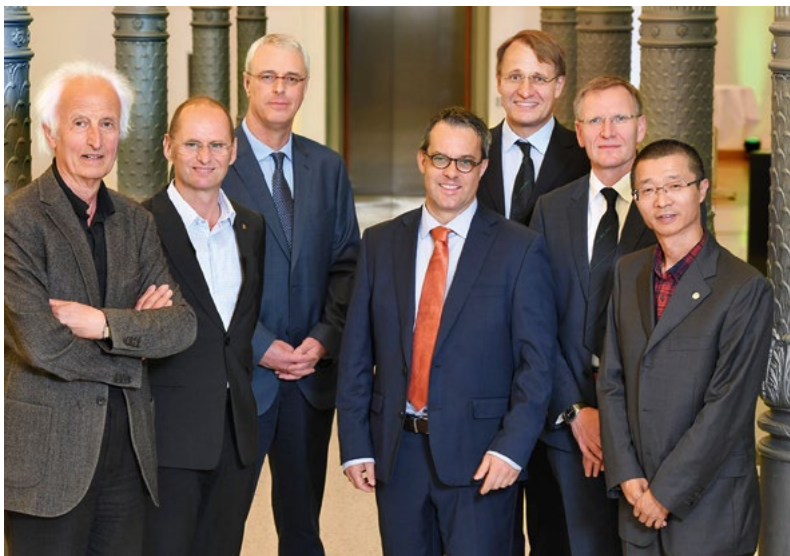


Photo: Humboldt Foundation/David Auserhofer

Federal Minister of Research Johanna Wanka and the President of the Humboldt Foundation Helmut Schwarz presented Germany's most valuable research award, the Alexander von Humboldt Professorship, to six top researchers from abroad in May this year.

Environmental microbiologist Largus T. Angenent, structural biologist Jijie Chai, plant molecular biologist Wolf B. Frommer, constitutional lawyer Ran Hirschl, epidemiologist Till Winfried Bärnighausen and philosopher Sven Bernecker have relocated to Cologne, Göttingen, Tübingen and Heidelberg on the strength of their Humboldt Professorships.

Financed by the Federal Ministry of Education and Research, the award comes with funding of up to five million euros. It is granted by the Humboldt Foundation to eminent, internationally-recognised researchers of all disciplines working abroad.

Presentation of the Humboldt Professorships: Foundation President Helmut Schwarz together with the new award winners

# LOTS OF LITTLE CONCERTS

Who actually does what at Humboldt headquarters? Who are the people behind the scenes making sure that everything runs smoothly? This page is devoted to the colleagues at the Humboldt Foundation, their lives at work and beyond. **TODAY: SYLVIA SPRÖTGE.**



Photo: Humboldt Foundation / Michael Jordan

My very favourite job is the Wardwell Fellowship. It's one of our smallest programmes and thus not very well known. But it means a great deal to me. It is devoted to promoting young musicians from Spain. Once a year, I go to Madrid for the applicants' auditions. Every candidate plays two pieces followed by an interview with the selection committee. The musicians are still very young, usually in their early twenties. Despite the odd attack of nerves, they are all very professional and their music is often wonderful. It's like spending a whole day listening to a series of little concerts.

As I myself am a musician with Spanish roots, it's the ideal programme for me. I started playing the saxophone when I was eleven and music was one of the ways I financed my studies. Originally, I wanted to be an architect but during university I realised that the

daily round is often much less creative than I had imagined. So, I concentrated on music and looked for a "solid" job – which brought me to the Humboldt Foundation. What I enjoy so much about it is that I can be creative and make things happen, to a much greater extent than you might expect in science administration. And that's true of the other areas I am involved in, too: our big IT projects related to selection procedures and my work as chair of our works council.

I still do as much music as possible, playing the saxophone or singing in a cappella ensembles. Incidentally, I also lead our inhouse choir "Chora et labora". We regularly sing in our breaks and I am thrilled that so many colleagues are as enthusiastic about music as I am.

*Recorded by* **GEORG SCHOLL**



A photograph of a restaurant table setting. In the foreground, a white plate with a scalloped edge is mostly empty, with a silver fork resting on it. The plate has some small, golden-brown crumbs scattered on it. To the left of the plate is a white cup of coffee on a saucer. In the background, there is a glass of water and another cup of coffee. A red and white striped napkin is visible in the bottom left corner. The text is overlaid on the image.

**THIS IS WHERE  
THE ENGLISH  
VERSION FINISHES.**

BITTE WENDEN SIE DAS HEFT,  
UM DIE DEUTSCHE FASSUNG ZU LESEN.