

Creating Chemistry

BASF's sustainability
magazine

Digging deeper
for green energy:
A good idea?

A new age:
The science
of youth

Issue
2025



Turning
a corner

Towards
a new
mobility

 **BASF**
We create chemistry

Behind the scenes



Nele-Marie Brüdgam

They both share a passion for the sea, so it's no surprise that our author and the conservationist Martina Sasso were instantly on the same wavelength. Brüdgam was impressed by the Argentinian activist's drive and her way of dealing with failure: Now more than ever! is Sasso's motto. The resulting profile is an homage to Sasso's tireless commitment. **PAGES 36 - 41**



Tom Huber

Mobility expert Stefan Gössling was in Freiburg when we conducted the interview and suggested meeting photographer Tom Huber there. Huber took him on a photo safari around the railway station: "I'm particularly drawn to unremarkable corners and everyday places as backdrops for my pictures. For the people I'm photographing this can sometimes seem a little strange or amateurish. But Stefan Gössling was very open to it." **PAGES 14 - 17**



Edward Carvalho-Monaghan

How can you illustrate artificial intelligence? For this issue, Edward Carvalho-Monaghan interprets it as an idealized source of knowledge: "For me, AI is not a machine-powered god, but a collection of images and texts, like a virtual Library of Alexandria." In his illustration, the peacock feather symbolizes India, while the falcon stands for the Egyptian sun god Ra. **PAGE 30**

Cover: Yosigo; Photos: private (3), Yosigo

Have we arrived?

Not by a long shot. But we're on the right path: towards greener, more equal, seamless transportation. In our focus section, we present ideas and visions for tomorrow's mobility. Join us on this exciting journey.

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We welcome your feedback

How do you like Creating Chemistry?
Which topics would you like us to cover?
Share your thoughts and ideas with us:
creating-chemistry@basf.com

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Photos: Tom Huber, PH-5 von Poul Henningsen/courtesy of Louis Poulsen, Joel Reyero, Illustration: Manuel Borioletti

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Argentina’s south coast is a pristine paradise – Martina Sasso is fighting to keep it that way. Page 36



Changing

We're on the eve of a mobility revolution that will greatly alter our urban landscapes. Let's take a look around the globe at some of the ways that the future of mobility is already being envisioned.

PHOTOS
Anton
Repponen

TEXT
Frank
Giese

direction

R

Rush hour in the city: The after-work traffic crawls slowly through the airspace between the skyscrapers, the yellow hover taxis, cargo drones and flying limousines glide at a snail's pace through the endless canyons of streets. Only a limited number of flying craft are allowed to thread their way into this maze to avoid the risk of air traffic gridlock...

Airspace? Flying taxis? While the scene so cheerfully exaggerated in the 1997 science fiction classic "The Fifth Element" with Bruce Willis remains firmly in the realm of fantasy, there's something the film and our reality have in common: The world is increasingly fusing to become a city, and urbanization is one of the megatrends of our time. Today, 57 percent of the world's population lives in cities, and according to U.N. calculations, this will rise to around 70 percent by 2050. It's a trend that is fueled by several factors: The world's population is growing, the global south is in the grip of a rural exodus, and people in the north are being drawn to city life. However, as cities increasingly sprawl, their infrastructure needs to keep pace, especially for transportation. Efficient urban mobility networks are crucial for people to be able to get to work, enjoy their leisure time and connect with each other. In short, mobility is essential to allow us to participate in society and play a part in shaping it. But how can we integrate as many people as possible, including those who live in the remoter outskirts of these rapidly growing metropolitan areas? The following examples offer solutions.

Flying high

As a passenger, the first thing that strikes you is the absolute silence. While the city seethes below your feet, you float serenely in the glass cocoon of the cable car cabin above the rooftops and streets. Traveling to work at a height of 50 meters is all part of the ordinary commute for many people in La Paz. In the metropolitan area around

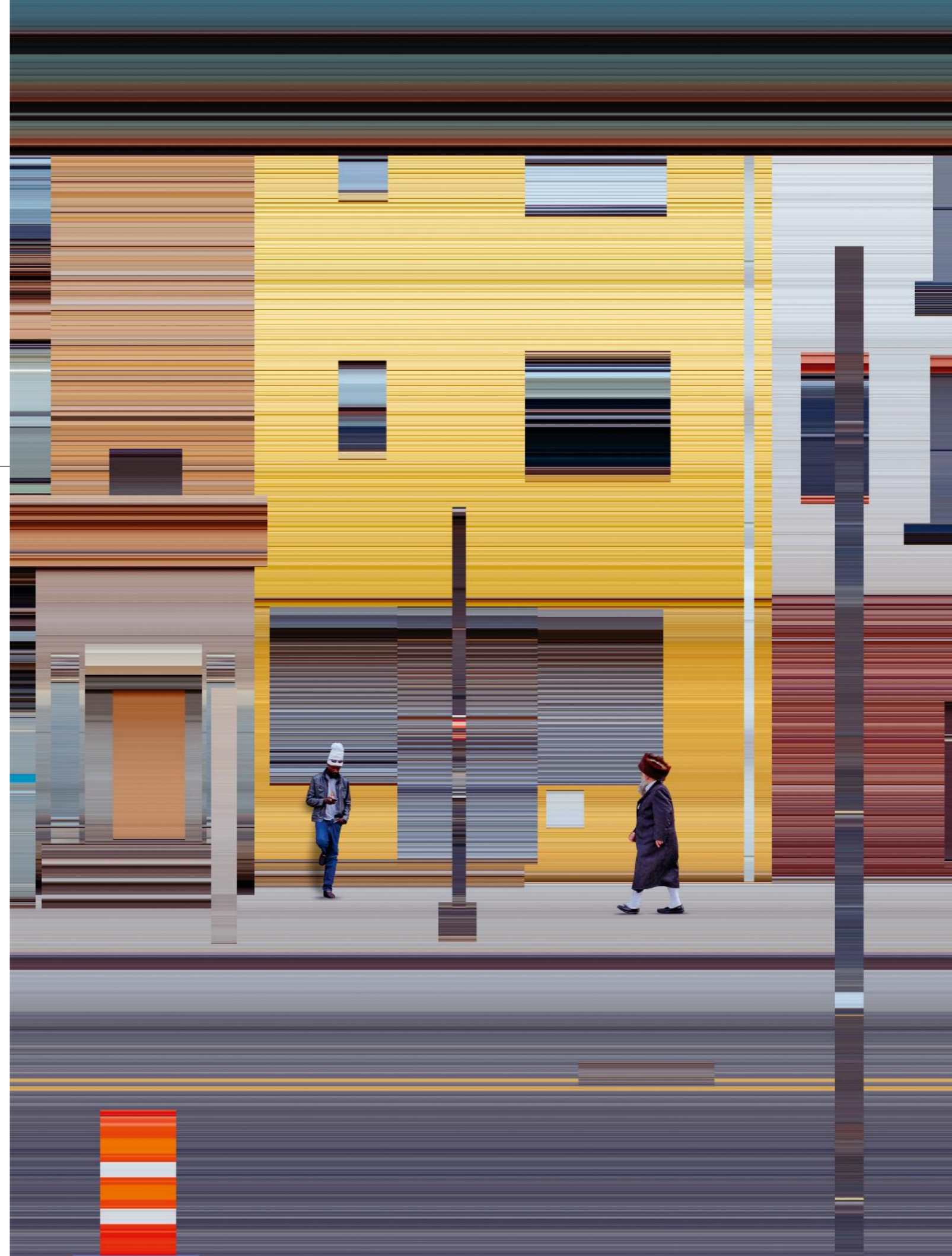
the Bolivian capital with its roughly two million inhabitants, people take the "Teleférico" just like they would take the subway or bus elsewhere. The first three lines of the urban cable car started operating in 2014, and today it is the largest system of its kind in the world, covering a network of 33 kilometers. Around 1,400 cabins glide over the densely built-up residential areas on ten lines, with an average of around 300,000 passengers using the aerial mass transportation system every day. It is also a smart solution that makes what was long considered an insurmountable problem literally disappear into thin air: The greater La Paz area is 3,200 to 4,100 meters above sea level, and there are almost 1,000 meters in altitude to cover between the lowest and highest districts. Accessing them by road or subway is topographically impossible. Traveling up or down by bus or shared cab is an ordeal on narrow roads, and it's time-consuming and dangerous to boot. So, the Teleférico has become the backbone of local public transportation, whisking residents from outlying areas far from the city center into the city in around 30 minutes. As this instantly improves the chances of finding a job and boosts social inclusion, countries such as Mexico, Colombia and Madagascar have taken note and are rolling out similar projects based on La Paz's pioneering cable car system.

Making room

La Paz is a great example of a viable approach to new types of mobility and identifying solutions that do not follow the most obvious path, for instance solving traffic problems by building new roads or expanding existing ones. According to Mimi Sheller, an American mobility researcher and sociology professor, this has been one of the cardinal mistakes in urban transportation planning. And not the only one. "For decades, many cities have geared their infrastructure towards a single group of road users: commuters who drive from A to B, from home to work and back," says Sheller, who is Dean of the Global School at Worcester Polytechnic Institute in Massachusetts, United States. "This ignored the mobility needs of others, especially those of many people who do different types of care work and therefore often have to make many stops along the way. But transport planning took little account of this."

Until now, that is, because times are changing. And this change is essential if cities are to offer as many people as possible a wide range of mobility options, rather than just certain groups. However, it usually requires the layout of traffic areas and public spaces to be rethought. "The population density of growing cities is constantly increasing, and the available urban space is becoming scarcer and scarcer," says Lynette Cheah, Professor of Sustainable Transport at the University of the Sunshine Coast in Queensland, Australia. "This will eventually lead to the inevitable question: Do we want to keep sharing this precious resource with big cars – or rather with public transit and small alternative modes of transportation that are cleaner, more efficient and take up significantly less of the space we need for people?"

City authorities around the world are coming up with answers to this question and have their sights set on reducing car traffic in favor of other modes of transport. Paris is one of the pioneers: For a good decade now, the city council of the French capital has been pushing to become a 15-minute city, closely followed by ↴





Portland, United States, Melbourne, Australia and Shanghai, China. The concept is straightforward: The aim is to allow most Parisians to reach important everyday points of contact such as schools, authorities, doctors' offices, recreational or sports facilities within a quarter of an hour on foot, by bike or by public transportation. The city council is tackling this by adding new cycle routes to the famous boulevards, many of which are already subject to a 30 km/h speed limit, by doubling the size of the metro network to 450 kilometers, and with plans to ban the last gasoline-powered vehicle from the city center by 2030. Norway is pursuing a similar program: The e-mobility pioneer in northern Europe has set itself the goal of having zero new combustion vehicles registered after 2025 (for more on battery recycling, see page 13). In addition, around 30,000 autonomous shuttle buses are to be added to the local transportation network at the beginning of the next decade. Milan, Zurich, London and Copenhagen are also pushing ahead with mobility changes that include congestion charges, parking restrictions in the city center, or a combination of both. Singapore is taking a particularly resolute approach: The city-state is rolling out driverless subways and wants to build stations close to 80 percent of its citizens. Meanwhile, only one in ten people still own a car here: "If you want to register a vehicle in Singapore, you have to pay four times the purchase price in taxes," says Cheah.

Reducing friction

But what applies to car ownership in Singapore is quite different elsewhere in the world. Sociologists and mobility researchers have revealed in numerous studies how important a car is for professional success and social status, but also for individual satisfaction. It is hardly surprising that in the car-centric United States, car ownership has been shown to significantly increase the chance of a better job and salary. The 2020 study "Does lacking a car put the brakes on activity participation?" by Eric Morris, Evelyn Blumenberg and Erick Guerra provides enlightening insight. The U.S.-based professors of urban planning used data from various countries to show that people who do not have access to a private vehicle are significantly less likely to take part in activities outside the home, such as sports or volunteering. They also found that these people are most likely to miss out on activities "associated with high subjective well-being" and that "constrained mobility comes with significant emotional costs." In other words: The lack of a car leads to a lower quality of life.

So do we need cars – or do we need fewer cars? There is no one-size-fits-all solution; ultimately, it all comes down to trial and careful calibration. Following protests from citizens

ABOUT THE IMAGES

Designer Anton Repponen hails from Estonia and lives in New York. His "Time Stretched" series examines the interplay of time, movement and human perception. The environment appears frozen in a distorted time structure, while the central figure remains unchanged – as if trapped in a time bubble.

and businesses, Oslo's city council was forced to abandon its initial plan to ban cars from the city center. The mayor of Paris, Anne Hidalgo, has every major proposal legitimized by public consultations, so far with success. "If new transportation concepts are met with disapproval, you have to investigate whether they might make life more expensive or more difficult for some people. Or whether the plans were perhaps not communicated well," says Sheller. "And you have to take time to find out in pilot projects: Do the measures actually reduce traffic? Do they improve air quality? Are they even affordable? If all this is the case, most people will accept changes, often even learn to appreciate them, but you have to include people on the way to this goal."

The ideal of new urban mobility is ultimately based on what experts call "intermodal mobility." This boils down to creating the infrastructure that allows people to move around the city in the most convenient, efficient and eco-friendly way possible, using seamlessly interlinked modes of transportation. A simple example of an intermodal trip is traveling by car to a Park+Ride station, by train to the city center and by rental bike to your final destination, e.g. the workplace. The concept of shared mobility has established itself in

recent years, building general acceptance for the integrated transportation networks and the mindset that are required. There is a clear shift from ownership to renting and sharing vehicles. Examples include car sharing, the use of shared cabs or individual ride services that can be ordered by app, such as Uber or Grab – and, at the end of the chain, micromobility services.

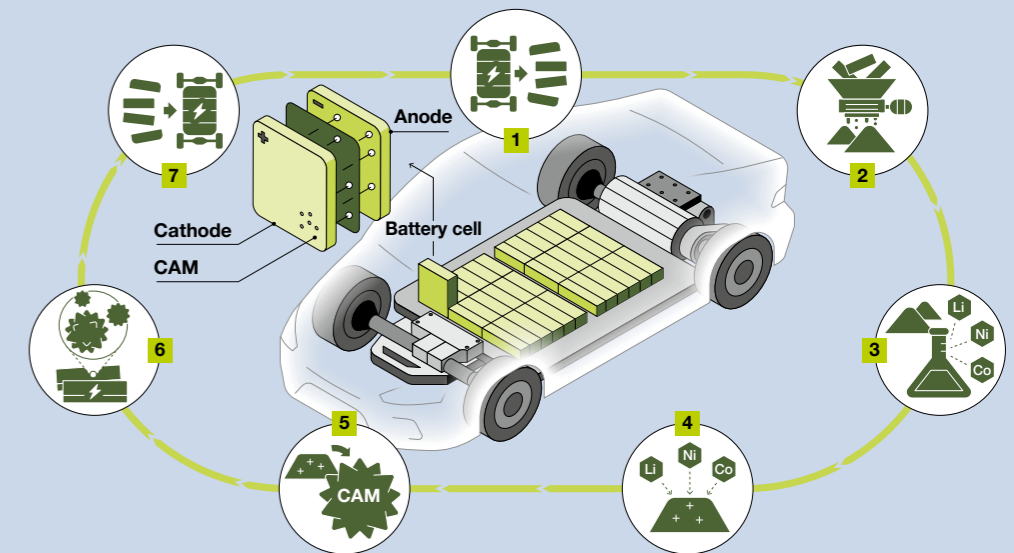
Filling the gap

From rental bikes to e-scooters: Within the space of only a few years, micromobility has taken off in many cities around the world. And with good reason: Thanks to their flexibility, alternative forms of transport find niches in many places. One example is the Gojek scooter cab service, which is practically ubiquitous in Indonesia. Customers use an app to book a scooter driver who maneuvers them through congested streets, past never-ending streams of traffic and miles of traffic jams. In addition, these and other mobility options such as e-scooters or rental bikes can close the gap between private vehicle ownership and local public transportation services, the keyword being the "last mile." However, this will only work "if micromobility solutions are carefully managed by the cities," says mobility expert Dr. Maya Ben Dror, co-founder of the Global New Mobility Coalition at the World Economic Forum. "If, on the other hand, e-scooters or rental bikes are not consciously integrated into the urban transportation mix, their proliferation can lead to increased competition for scarce space or to confrontations with pedestrians – and quickly undermine the benefits of shared mobility and turn them into their opposite." There are already examples of this: Paris and Melbourne have banned rental e-scooters due to safety concerns, while London, Copenhagen and other cities tolerate them, but impose strict conditions. For Ben Dror, this is the result of a systemic failure: "For shared mobility systems to work, ↘



Circle of power

People around the world are increasingly opting for electric vehicles. This reduces emissions and is good for the climate, but also poses new challenges. The demand for lithium-ion batteries has increased, as has the quantity of raw materials required, such as lithium, nickel, cobalt and manganese (see infographic on page 23). This means that recycling is needed in order to grow and promote electromobility in the long term. BASF is building networks in Germany and the United States to enable a sustainable circular economy, which uses recovered raw materials to produce new battery components. For instance for cathodes, a main battery component, and the one where the electrochemical reaction takes place that triggers the flow of electricity to power electric vehicles.



1. Spent lithium-ion batteries are dismantled and deep-discharged to eliminate the risk of fire and explosion.
2. The old batteries are shredded, sieved and dried, with materials like plastic removed. The resulting compound is called black mass.
3. Using a chemical process, BASF extracts high-quality

recyclable metal salts containing lithium, nickel and cobalt from the black mass.

4. The extracted metal salts (and new primary raw materials) are used to produce new precursors for cathode materials.
5. BASF processes these precursors into cathode active materials (CAM), a key component of lithium-ion batteries, as it

influences their performance, safety and cost.

6. BASF supplies the cathode material to battery cell manufacturers who produce modules for new lithium-ion batteries.
7. The circle is complete: Car manufacturers combine the modules into battery packs and install them in new electric and hybrid vehicles.

you need an infrastructure that prioritizes the most sustainable and efficient means of transport. Bicycle lanes and e-scooter parking zones can help to avoid conflicts.”

Sheller believes that the first step should be to evaluate the benefits of such mobility services for the community. “Anyone who wants to expand micromobility and allow more and more new services should first ask themselves: Who are these systems actually aimed at, whose needs are they targeting? We know from surveys that many people don’t have the confidence to use these vehicles or that they don’t feel able to handle the necessary apps and digital platforms. And in the end, this does not lead to greater mobility equality, but rather to new inequalities.”

One for all

Does the service deliver benefits? Is the technology easy to use? And is it financially viable to operate? These are core questions that will determine how shared mobility develops in many cities. It is still a young, highly competitive field of business in which takeovers and bitter competition are so frequent that even experts are

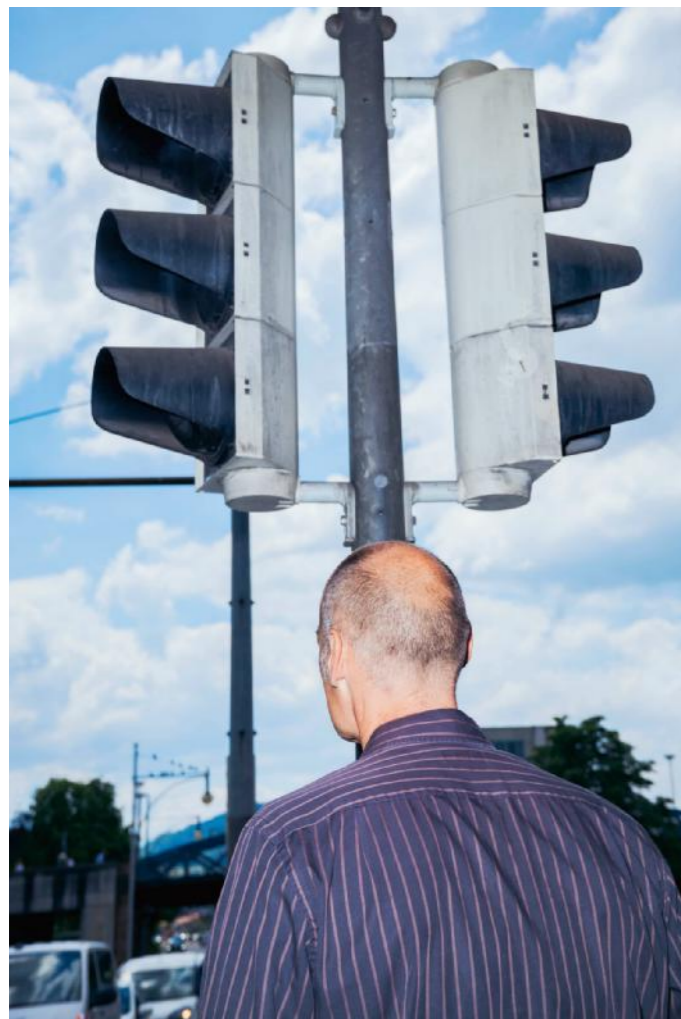
reluctant to make forecasts. To ensure long-term success, it is crucial that sharing services do not remain isolated solutions that users book and pay for individually; instead, to make them attractive and convenient, they should be used and billed in conjunction with other mobility services. Examples of how modal transport – from e-scooters and car-sharing vehicles to buses and trains – can be intelligently linked include the DiDi platform, which is used across countries in the Asia-Pacific region and Latin America, the Transit app for more than 600 cities worldwide, and the Rome2Rio platform, which can be used globally.

As these examples illustrate, there are mobility concepts and solutions all around the world that can empower us to master the challenges of navigating urban life, even in rapidly growing metropolitan areas. What these solutions are unlikely to include are flying yellow cabs hovering in traffic jams up in the air. Futuristic scenes like these seem destined to remain firmly parked in the world of science fiction. ■

Everywhere and nowhere

INTERVIEW
Frank Giese

PHOTOS
Tom Huber



Distant places and home. The desire for discovery and travel as a lifestyle. The risk of excessive travel contrasting with new ideas that fuel our personal journey. Are we getting carried away with mobility? A conversation with Stefan Gössling, Professor of Sustainable Tourism and Mobility at Linnaeus University in Sweden, about the risks and opportunities at the heart of a mobile society.

Without humanity's innate urge to explore distant places, the earth would not have been colonized, Marco Polo and James Cook would never have embarked on their expeditions, and humankind would not have dreamed of venturing into space. So, is the desire to travel embedded in our genes?

As inherently mobile beings, we carry an evolutionary legacy in this regard. Our history is defined by a perpetual search for new habitats. Nowadays, though, our motivation for being on the move is usually slightly different. For travel, the key segment is 3S tourism (short for "sun, sand and sea"), as relaxation is a key goal for most people. Sport is another central motive, with ski tourism drawing millions of people to winter resorts every year. Social reasons, such as spending time with family or meeting new people, can also play a role.

Is it this constant pull between a settled lifestyle based on routine and the desire to break free and be different that drives people out into the world?

Basically, yes. Travel also means reflecting on the place where you live, for example in terms of nature and culture. But I also see a growing desire to escape from everyday life. ↘



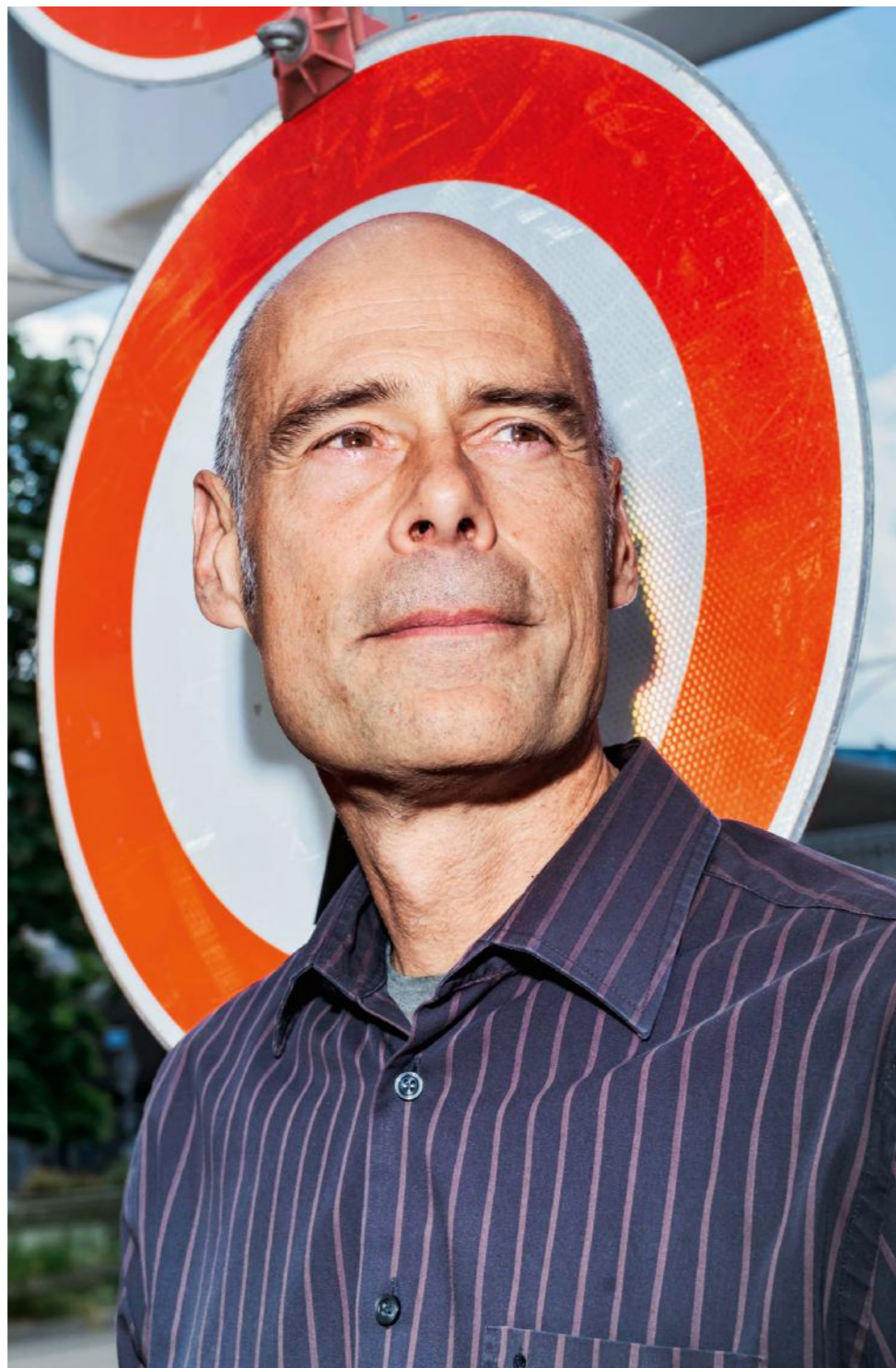
We are more driven now than we were 20 years ago. Trips are shorter, we check a destination off the list. It has become almost a requirement for young people to take a “gap year” when they finish school, and the aim seems to be to get as far away as possible; Australia and New Zealand are very popular. And, of course, status considerations also play a role in the choice of destination. You travel to show that you’re an interesting person. In a study dating from 2016, we showed how social media has made these motives even more important.

There are also people who don’t travel by choice but have to be mobile for professional reasons. You have used the term “hypermobility” to point out that society tends to glamorize frequent travel while ignoring its downsides. What are these downsides and what are their consequences?

People who are constantly on the move are exposed to various health risks, including jet lag and disorientation, upheavals in family life, and often also the impact of poor nutrition and a lack of exercise. This is especially problematic for business travelers. A sleep researcher once compared jet lag to being drunk, with all the implications for one’s work, which I thought was particularly apt. But I also remember the story of a business traveler who found his family growing increasingly distant – until his marriage failed. Young employees are often persuaded that having to travel is a desirable lifestyle, while older employees understand the consequences but find it difficult to escape the constant traveling required as part of their management role. During the pandemic, we saw just how unnecessary many business trips actually are. The economy kept going – even without air travel.

The covid-19 pandemic drastically limited the freedom of billions of people to move about. Did this have an impact on mobility behavior?

No, and we are certainly seeing a rebound effect now, with people traveling even more than before. Everyone seems to feel that they need to catch up. At the same time, the pandemic was important for showing us just how much air travel exacerbates global warming. Emissions dropped by about six percent during the pandemic, mainly due to the lack of air traffic. To stabilize global warming, we would need a six percent reduction in emissions every year, which is something I very much doubt we will manage. Given these circumstances, we should brace for the age of non-tourism to begin in the next 10 to 15 years. Due to climate change, more and more countries will no longer be viable travel destinations – either because of extreme weather



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events or the lack of social, economic and political stability in many parts of the world.

These scenarios give new meaning to the cost of mobility. We all know that the true cost is much higher than what we pay for airline tickets or gasoline. But how could these costs be factored in?

Most people think they are being fleeced when they buy a car and are required to pay taxes and fees. In reality, car ownership in a country like Germany is commonly subsidized by more than 5,000 euros per year – partly because the cost of climate change is not factored in. This applies even more to air travel, a sector that could not survive without subsidies. Currently, such costs are being carried by the general public.

Can you explain that?

Over the past 40 years, airlines have made an average profit of around 80 cents per passenger – and only because air travel is subsidized. There is no country in the world that charges VAT on international flights; you don’t have to pay for the climate damage you cause, the government subsidizes many airports that do not make a profit. In countries like Germany, there is something of a carbon tax, but it would have to be about ten times higher to cover the estimated minimum cost of the damage caused by emissions. This is an undisputed scientific fact. At EU level, efforts are being made to reduce emissions, and the Green Deal aims to make Europe climate-neutral by 2050. But so far, things are not happening fast enough and there are too many exceptions.

Cars, i.e. private transportation, are slowly being pushed back and replaced in many cities by new forms of mobility, such as car sharing, e-scooters and soon maybe even robocopters. Is this progress or are we simply creating an excess of mobility options?

The key question is: Which modes of transportation are in fact useful? If we all took off in private helicopters, the airspace above the cities would get crowded – it doesn’t take much imagination to realize that. Many other things depend on how we choose to handle cars. We are at a crossroads: If we keep them, especially after they become autonomous, we will grow more and more reliant on them as they become increasingly convenient. But if we move away from private cars and clearly prioritize bikes, public transportation or individual mobility services, we make these modes of travel far more attractive – and at the same time free up urban spaces that could be repurposed. It has been shown that this would massively improve the quality of life in our cities.

It sounds like you aren’t entirely pessimistic about the future of mobility, despite the significant problems attached.

We can gain a lot from new mobility, especially in urban areas, but political institutions are ignoring the facts. All over the world, countries experiencing rising incomes and prosperity are following the development patterns of the industrialized nations, for instance in terms of car ownership. The West could develop a counter-model, but it isn’t doing so. We talk about transforming transportation, but we are not listening to the visionaries. How you get around, incidentally, is also a cultural issue: If you grew up with a car, you are likely to drive a car; if you grew up with a bike, you’ll probably ride a bike. It’s no coincidence that up to 60 percent of all trips in cities in the Netherlands are made by bike. So, it is possible to change. But that takes more than simply redesigning transportation infrastructure; you also have to educate and actively promote these changes to generate widespread public support. ■

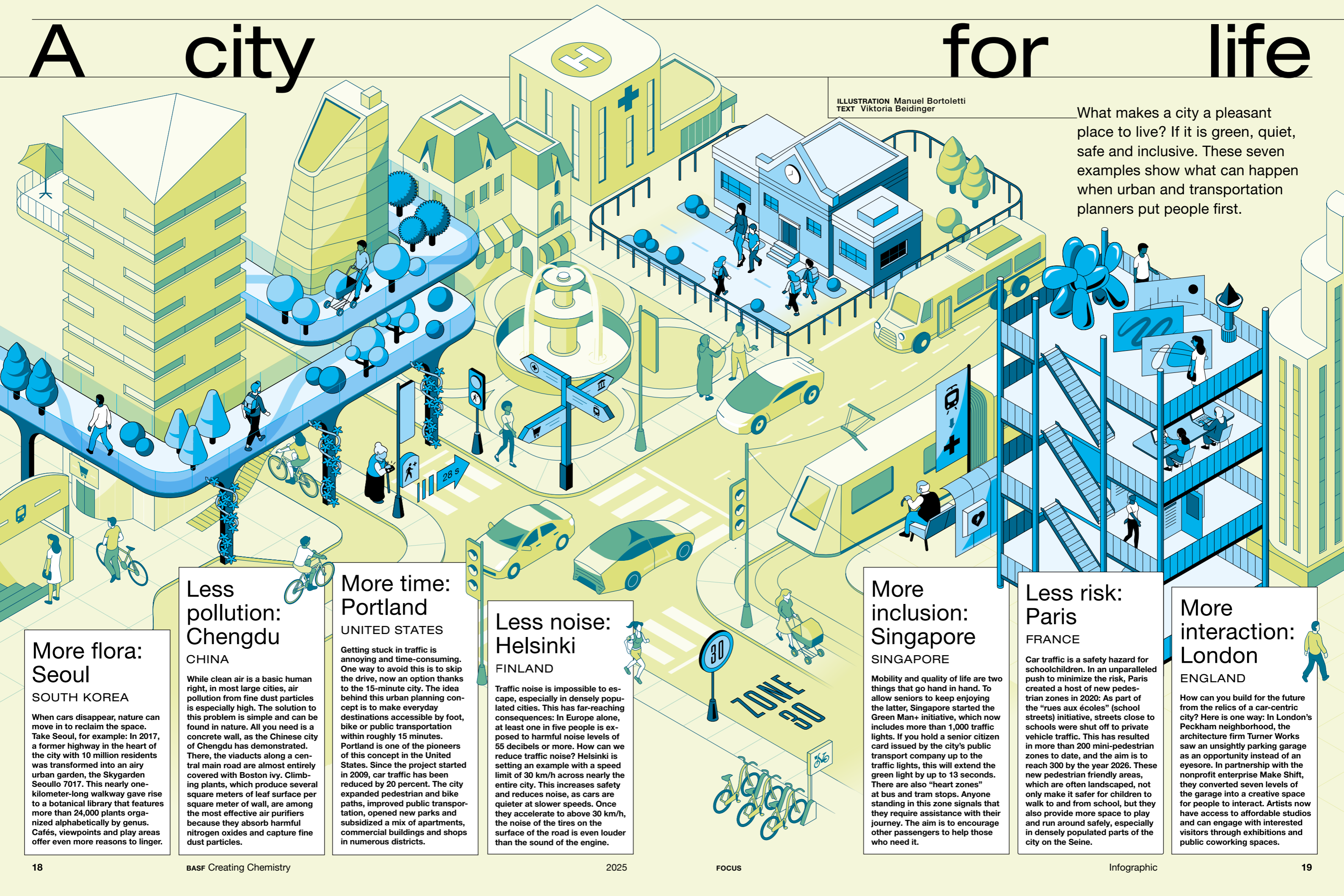


“The age of non-tourism will begin in 10 to 15 years.”



ILLUSTRATION Manuel Bortoletti
TEXT Viktoria Beidinger

What makes a city a pleasant place to live? If it is green, quiet, safe and inclusive. These seven examples show what can happen when urban and transportation planners put people first.



More flora: Seoul

SOUTH KOREA

When cars disappear, nature can move in to reclaim the space. Take Seoul, for example: In 2017, a former highway in the heart of the city with 10 million residents was transformed into an airy urban garden, the Skygarden Seoulo 7017. This nearly one-kilometer-long walkway gave rise to a botanical library that features more than 24,000 plants organized alphabetically by genus. Cafés, viewpoints and play areas offer even more reasons to linger.

Less pollution: Chengdu

CHINA

While clean air is a basic human right, in most large cities, air pollution from fine dust particles is especially high. The solution to this problem is simple and can be found in nature. All you need is a concrete wall, as the Chinese city of Chengdu has demonstrated. There, the viaducts along a central main road are almost entirely covered with Boston ivy. Climbing plants, which produce several square meters of leaf surface per square meter of wall, are among the most effective air purifiers because they absorb harmful nitrogen oxides and capture fine dust particles.

More time: Portland

UNITED STATES

Getting stuck in traffic is annoying and time-consuming. One way to avoid this is to skip the drive, now an option thanks to the 15-minute city. The idea behind this urban planning concept is to make everyday destinations accessible by foot, bike or public transportation within roughly 15 minutes. Portland is one of the pioneers of this concept in the United States. Since the project started in 2009, car traffic has been reduced by 20 percent. The city expanded pedestrian and bike paths, improved public transportation, opened new parks and subsidized a mix of apartments, commercial buildings and shops in numerous districts.

Less noise: Helsinki

FINLAND

Traffic noise is impossible to escape, especially in densely populated cities. This has far-reaching consequences: In Europe alone, at least one in five people is exposed to harmful noise levels of 55 decibels or more. How can we reduce traffic noise? Helsinki is setting an example with a speed limit of 30 km/h across nearly the entire city. This increases safety and reduces noise, as cars are quieter at slower speeds. Once they accelerate to above 30 km/h, the noise of the tires on the surface of the road is even louder than the sound of the engine.

More inclusion: Singapore

SINGAPORE

Mobility and quality of life are two things that go hand in hand. To allow seniors to keep enjoying the latter, Singapore started the Green Man+ initiative, which now includes more than 1,000 traffic lights. If you hold a senior citizen card issued by the city's public transport company up to the traffic lights, this will extend the green light by up to 13 seconds. There are also "heart zones" at bus and tram stops. Anyone standing in this zone signals that they require assistance with their journey. The aim is to encourage other passengers to help those who need it.

Less risk: Paris

FRANCE

Car traffic is a safety hazard for schoolchildren. In an unparalleled push to minimize the risk, Paris created a host of new pedestrian zones in 2020: As part of the "rues aux écoles" (school streets) initiative, streets close to schools were shut off to private vehicle traffic. This has resulted in more than 200 mini-pedestrian zones to date, and the aim is to reach 300 by the year 2026. These new pedestrian friendly areas, which are often landscaped, not only make it safer for children to walk to and from school, but they also provide more space to play and run around safely, especially in densely populated parts of the city on the Seine.

More interaction: London

ENGLAND

How can you build for the future from the relics of a car-centric city? Here is one way: In London's Peckham neighborhood, the architecture firm Turner Works saw an unsightly parking garage as an opportunity instead of an eyesore. In partnership with the nonprofit enterprise Make Shift, they converted seven levels of the garage into a creative space for people to interact. Artists now have access to affordable studios and can engage with interested visitors through exhibitions and public coworking spaces.

Shipping

reloaded

TEXT Jan Berndorff



Photo: Yinwei Liu/Getty Images

Ambitious: The 176 member states of the International Maritime Organization aim to achieve net-zero emissions in global shipping by 2050.

More connections, better efficiency, lower emissions: Cargo shipping operations face the challenge of moving increasing volumes of freight around the world without impacting the climate or causing additional road congestion. How can we achieve this? Here are some innovative ideas for shipping goods by water, air and rail.

Water: on course for less carbon

With around 90 percent of global trade handled by ship, making marine traffic climate-friendly is a pressing challenge. How could today's huge container vessels and their vast need for energy be modified for the future? There are some promising ideas out there.

In inland shipping, cargo ships can be powered by batteries, just like cars. Using electricity generated by wind, solar power or hydropower makes these trips climate neutral. The first e-freighter, Greenwater 01, began regular service in China in 2024. It is 120 meters long, carries up to 700 standard containers and travels on the Yangtze River.

The massive freighters that handle goods intended for global markets, on the other hand, consume far more energy than batteries can provide. There are plans to replace the heavy fuel oil they run on with alternative hydrocarbon compounds like methanol. Although methanol is mostly produced from natural gas or coal, it can also be produced from biomass or as an e-fuel, using electricity from hydrogen and carbon dioxide. ↘

The first methanol freighter, the Danish Laura Maersk, was launched in 2023. It holds over 2,000 standard containers. To put that into perspective: The largest container ships can carry nearly ten times the cargo.

Yet even tankers carrying liquid freight or gas can be made climate-neutral – if you capture the CO₂ from their exhaust gases and store it for other uses on land. BASF offers the OASE® blue technology for this process, a method for cleaning exhaust gas that is also used in industrial plants, such as in the production of cement. Its Chinese partner company CPGC intends to install this technology on tankers carrying liquified natural gas (LNG).

Inspiration also comes from the distant past: In 2023, the Pyxis Ocean became the first bulk cargo freighter to use sails. Its two wing-like sails made of steel and fiberglass composite can be aligned with the wind and reduce fuel consumption by up to 30 percent.

Air: gliding like a shark

When goods need to be transported far and fast, air-planes are the only way to go. Air traffic is particularly harmful to the climate, but there are new ideas being forwarded on how to reduce greenhouse gas emissions to zero by 2050.

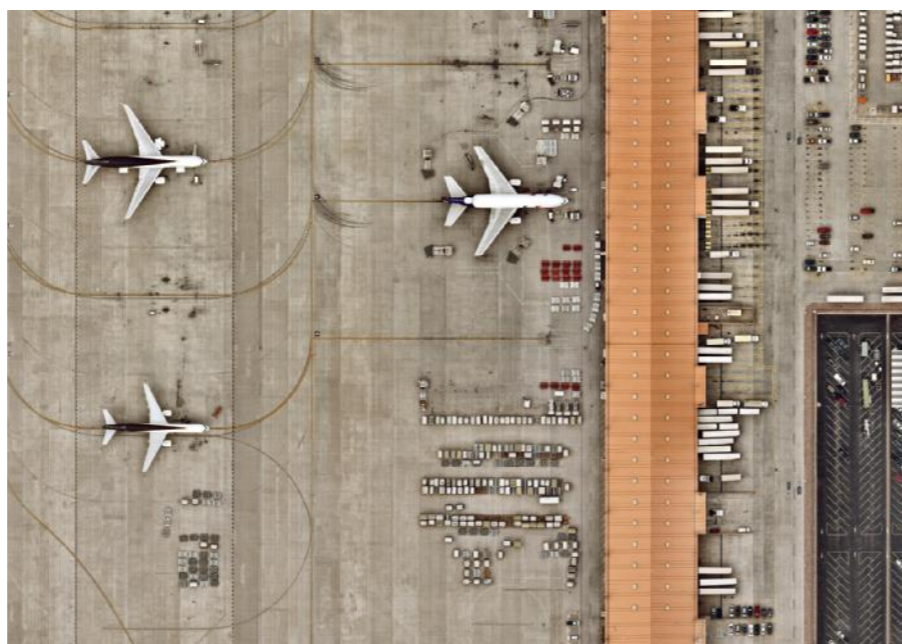
One solution is the use of new drive systems: Small planes on short-haul routes could be powered by batteries, mid-sized aircraft on medium-haul routes by hydrogen and fuel cells, and long-haul jumbo jets, which generate the most emissions, could be powered by e-fuels or alternative fuels made from biomass. These are greenhouse gas-neutral and could also reduce the formation of vapor trails, which are formed when water molecules attach to particulate matter emitted by the aircraft and freeze at high altitudes. These ice clouds amplify the greenhouse effect by blocking the heat radiating off the surface of the Earth. However, as these new fuels are in the development phase, they are still very expensive.

For now, the best approach is to conserve as much kerosene as possible. One effective strategy involves improving aerodynamics: More and more aircraft are being equipped with winglets, which are upward-curving wing tips inspired by birds' wings. They can reduce fuel consumption by around 5 percent. Results of a similar magnitude can be obtained by optimizing the surface of a plane. Here, shark skin serves as a model: BASF and Lufthansa Technik have jointly developed a functional film with microscopic ridges for the exterior shell of aircraft called NovaFlex SharkSkin. By optimizing the airflow, it can reduce kerosene consumption by as much as 3 percent. Lufthansa Cargo now plans to equip all of its existing Boeing 777F cargo planes with this technology.

New, lighter yet sturdy composite materials for the plane fuselage and optimized airflow in the engines can decrease fuel consumption even further. Another option is to adjust flight altitudes based on weather conditions to prevent the formation of vapor trails.

1.5

The average volume of freight (in metric tons) transported globally by ship per inhabitant in the world each year.



One plan by the EU to reduce greenhouse emissions: Avoid kerosene! Fuel suppliers must ensure that EU airports get a minimum proportion of sustainable aviation fuel – 2 percent as of 2025, 34 percent by 2040 and 70 percent by 2050.

Rail: racing to catch up

Compared to trucks, trains are a much more efficient and climate-friendly way to transport freight, especially as most of the system is already electrified. Trucks still win when it comes to flexibility – but that could change in the future.

To shift more freight to rail and relieve road congestion, railways must become more attractive and increase their speed and flexibility.

There is no shortage of ideas: The German Aerospace Center, for example, is working on the Next Generation Train. This concept aims to improve not only the trains themselves, which will be able to reach speeds of up to 400 km/h, but also the entire transportation chain. It involves optimizing the aerodynamics of trains as well as upgrading freight loading, unloading and transshipment facilities for switching between different modes of transportation. The locomotives will be made from lightweight aluminum and each wheel will be driven individually, allowing for more energy recovery during braking.

But the greatest progress can be made in the digital world: The use of artificial intelligence and data-sharing between stations, locomotives and even individual train cars enables far more precise, automated coordination of journeys and stops. The train cars will also be able to travel autonomously at lower speeds and couple themselves to other freight or passenger trains. For greater flexibility, they will be able to head to specific transshipment stations, where individual containers can be automatically offloaded from the train cars and loaded onto trucks. This way, only the final section of the transportation chain is handled by trucks.

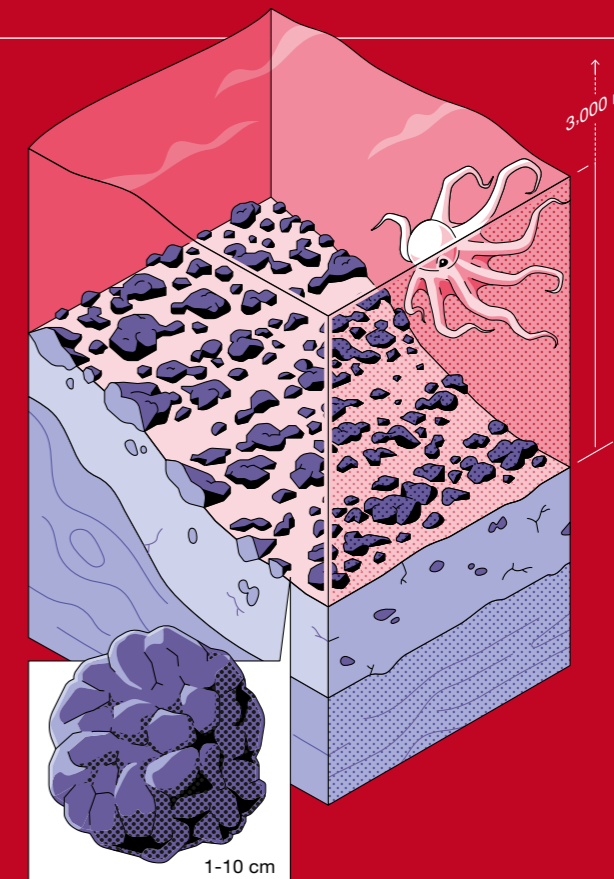
With all these changes it will be possible to increase the frequency of rail trips, use the rail network more efficiently and shift more freight from road to rail.

Photo: Nearmap/Getty Images

Manganese

Mn

Manganese is a silvery-white, hard and very brittle metal that never occurs in its pure form, but is primarily found in mineral compounds, such as manganese carbonate and manganese oxide. Billions of tons are contained in manganese nodules in the deep sea, particularly in the Pacific Ocean. Manganese is a vital trace element in the human body and is important for the formation of bone, cartilage and connective tissue. Humans have used this element for thousands of years: Manganese dioxide served as a pigment for cave paintings and has also been used since ancient times to color glass. Manganese also played a crucial role in industrialization. Since the 1840s, it has been added to cast iron to improve its malleability. In 1856, the British metallurgist Robert Forester Mushet proved that steel alloyed with manganese can be rolled and forged more effectively, resulting in a breakthrough for mass production. Around 90 percent of the manganese mined globally today is processed by the steel industry. Steel with a particularly high manganese content is used in industries such as automotive and mechanical engineering, and to manufacture components subject to high levels of stress, such as gears, bearings and railroad points.



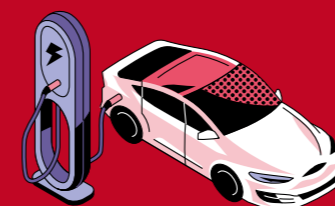
TAKE A DEEP BREATH
The latest research suggests that manganese nodules in the Pacific Ocean produce oxygen via electrochemical reactions.

ATOMIC NUMBER
25

AGGREGATE STATE
Solid

OCCURRENCE
Twelfth most common element in the Earth's continental crust

DISCOVERY
Swedish chemist Johan Gottlieb Gahn first extracted pure manganese from manganese dioxide in 1774 and is credited with discovering the element.



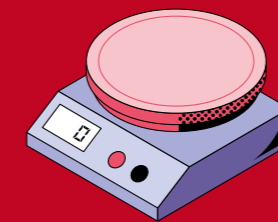
BUNDLE OF ENERGY
Manganese is a key component in electro-mobility. Advanced lithium-ion rechargeable batteries with a higher manganese content not only have a higher energy density and hence

a greater range than the previously dominant lithium batteries; they are also more cost-effective. The use of manganese reduces the need for more expensive components, such as cobalt and lithium.

A magnificent metal



CREATES AIR
Plants need manganese for photosynthesis; the element is essential for oxidizing water to oxygen.



PRECISE MEASUREMENTS
Alloying copper with manganese and nickel yields a material with a nearly constant electrical resistance, which is ideal for making electrical measuring instruments.



CAPABLE OF MORE
Manganese is also used industrially in the production of fertilizers and disinfectants. In the future, manganese complexes could also be utilized as luminescent materials for smartphone displays.

Dare we



INTERVIEW
David
Schumacher

PHOTOS
Nicholas Albrecht &
Katrin Koenning



dig deeper?

The world is rapidly moving towards green energy production, which requires huge amounts of certain minerals. Extracting those materials will have a massive impact on ecosystems and surrounding communities. Two experts on the question: Is it worth destroying nature to save the climate?

W

Wind turbines, solar panels and electric car batteries – they are all needed for green energy and necessitate huge amounts of certain metals, such as lithium, copper, nickel or cobalt. As a result, global demand for these key minerals is expected to double and may even come close to quadrupling by 2050, based on estimates by the International Energy Agency.

If we are to achieve net zero emissions, we'll have to increase mining efforts in many parts of the world. However, there's a caveat: Few other industries have a more devastating effect on the surrounding environment. Is there a way out of the raw material dilemma?

Creating Chemistry has invited two experts to this conversation. How do they weigh the options?

The International Energy Agency is projecting that demand for the metals needed for the green transition will increase dramatically. So, do we need much more mining in the world?

DANIEL FRANKS: The renewable energy transition will require a larger amount of minerals that we haven't been mining a lot, like lithium and cobalt. On the other hand, we will need a lot less of raw materials like coal, for example. Overall, the amount of mining might even be less.

Mining these much-needed minerals will come at a cost. Ecosystems will be destroyed, workers will suffer from medical conditions. The negative effects are being discussed in many parts of the world.

DF: There are practices to significantly reduce the social and environmental impact. For them to be applied, the process of producing the minerals must be just and equitable. Local communities and governments need to be involved. Otherwise, the transition itself will be undermined.

MATHIS WACKERNAGEL: There are more and less harmful ways to obtain these minerals. Our biggest challenge is that our demand, the size of the human economy, has become much bigger than what Earth can renew. Using certain minerals might help us move away from depleting Earth's natural resources. What I'm getting at: The cost of not transitioning the economy is much higher.

How do you calculate that cost?

MW: I look at the world through a biological lens. Our accounts show that human use of Earth is about 1.7-fold the amount our planet can renew from a biological perspective – food, timber, fibers, absorbing excess CO₂ from fossil fuels. Some of that is used to extract and process minerals. A reasonable question would be: What amount of our planet's resources can be used in a sustainable way? Ecologists say about half the regenerative capacity of the planet, if we also want to maintain biodiversity and have a resilient planet.



Professor Daniel Franks is a geologist at the University of Queensland's Sustainable Minerals Institute in Australia. His focus is on the interconnections between minerals, materials and sustainable development. Franks comes from a mining family, which explains his great fondness for rocks. At the same time, he is developing plans to exploit minerals in a way that preserves ecosystems and communities.

Roughly put: We'd have to cut our consumption of pretty much every natural resource by three.

MW: Not every resource, but on average, this is correct. And we do not actually have to. Overuse, or overshoot as we call it, will end, the question is whether by design or disaster. Using 1.7 Earths is a market failure. We can therefore ask ourselves, how much higher would the prices of raw materials need to be to reduce material demand from 1.7 Earths to 0.5 Earths? The price might be so high that our economies could no longer operate properly – which just shows how far off balance we are. On the other hand, not adapting to that new world of 0.5 Earths is far, far more expensive as it would deplete the regenerative capacity of Earth on which every value chain depends. We don't pay the price now, but it's on the balance sheet. Not paying for the transition now will turn into a massive liability.

So transitioning to renewable energy is our only choice and there is no alternative to accelerating large-scale mining?

DF: Some people say because of the energy transition we need to somehow fast-track the approval of mining projects. I'm not one of those people. Despite the time pressure, we should put high environmental, social and governance standards on the extraction of minerals: That will create projects that have more resilience.

Because they create less political backlash?

MW: And economic ones, too. The reason why the overuse of the planet is so dramatic is because we don't pay fair prices for resources. Look at the provision of carbon credits, for example.

These are permits that allow companies to emit a certain amount of greenhouse gases. Similarly, there are compensation payments that are designed to offset the CO₂ emissions.

MW: They are still in the beginning stages, but they could help move economies towards a fairer compensation of those who provide minerals and the regenerative resources, including carbon sequestration. But the way it's often done now, very little financial value from the carbon credits flows back to the countries where the credits are actually produced. So those countries are legitimately skeptical about providing the rights to produce carbon credits.

They do so by preserving natural habitats, for example. But carbon markets are largely unregulated.

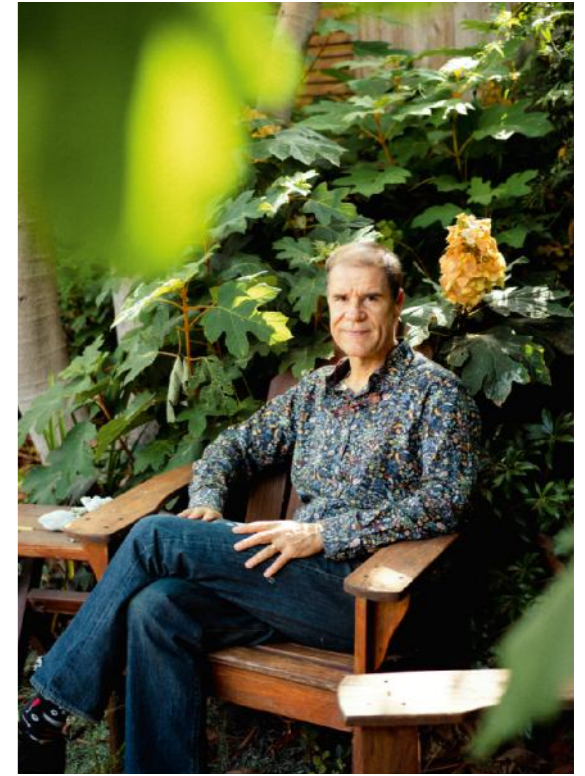
MW: Yes, they are poorly regulated. But the supply of resources would be much more reliable if a larger portion of the value chain these resources enable would go back to those countries and caretakers who provide the resources. This is true for both minerals and biological resources.

DF: Let's take lithium, for example. Over the past 20 years, Latin America has exported roughly 2,000 kilotons of lithium, and it imported 13 kilotons back in highly priced products, which is more than 150 times less.

“Local communities and governments need to be involved.”



Mathis Wackernagel at his residence in Oakland, California, surrounded by leaves, which he likes to call “nature's solar collectors.”



“We don't pay fair prices for resources.”

They just don't have access to their own minerals, which are needed for the transition. There's a huge justice and equity issue that we need to think about. Human security needs to be fostered in all its forms – energy, water, food and mineral security – so that all people have sufficient and affordable access to the resources that they need for human development.

Point taken. But why would mining companies share their profits with anyone other than their shareholders?

DF: The industry has been making a transition. For many years, it rejected the central elements of sustainable development, up until around about 2000, when it underwent huge pressure from civil society movements around the world about its performance. In the 25 years since then, it's made some progress in some places and little progress in others.

That's not very reassuring.

DF: We can no longer assume that a mining company is always a multinational giant, and that it has no relationship with its local setting. There are indigenous-led mining companies now, in Australia and Canada and other parts of the world. They have a totally different perspective, making sure that employment, development and environmental goals are being set and achieved. And that kind of innovation will feed into the multinational mining companies and junior companies as well.

So sustainable mining is possible, you say. Does that equal renewability?

DF: My view is somewhat different from Mathis'. Renewability matters more for biological systems.



Dr. Mathis Wackernagel is a co-founder of Global Footprint Network, an independent think tank promoting tools to advance sustainability. He was among the scientists who came up with the idea of ecological footprints of human activity, which has been used by climate activists. He also laid the groundwork for Earth Overshoot Day, the day when humanity's demand for resources exceeds what our planet can regenerate.

But we're talking about geological systems here. These are the forgotten elements of nature, as I like to call them. Minerals are not even mentioned in the United Nations Sustainable Development Goals. The world has come to think that renewability is the arbiter of what is sustainable. But most of the minerals that we're talking about for the energy transition are not renewable in human time scales, in terms of their geological production. Instead, they're infinitely renewable. Most of them are not really consumed during production or use. We can always recycle them and use them again. So they're basically going to be in stock forever.

And each of us owns a part of that stock, in our smartphones, laptops or vehicles. The question is: How much stock will we eventually need?

DF: There are projections by the International Energy Agency. But I think consumers will ultimately decide which products they prefer. That will change the demand for different commodities. But the markets for those commodities are not functioning well these days. We are seeing booms and crashes for lithium and nickel and other minerals. So it's hard for the industry to properly plan for that process.

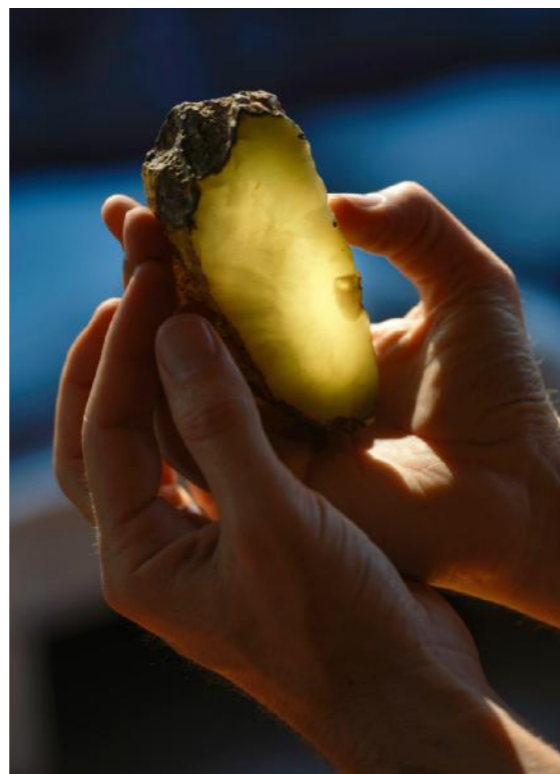
MW: It's important from a government's perspective, too. Among the economic development plans of countries, I haven't seen many, if any, apart from China, that take resource security seriously. But nations that want to secure a successful future would each need to do that for themselves.

Higher prices for urgently needed minerals are to be expected. This, in turn, will slow down the global transition in the energy sector.

DF: I don't necessarily think that producing minerals responsibly will result in a higher-priced end product. To keep prices in check, we need more equitable ↘



In his home in Brisbane, Australia, Daniel Franks keeps treasures like this mineral, dug out by his grandfather, who was a miner.



distribution of the revenue along the value chain. Higher standards, environmental, social, labor-related, don't necessarily increase the cost of production – in fact it's the irresponsible projects that often face huge delays and disruptions.

That sounds counter-intuitive.

DF: Keep in mind, minerals are located where they are. It's not like a factory where you can move to a low-priced jurisdiction. Major costs are incurred by mining projects when they lead to conflict with local communities, indigenous peoples and governments. Because it's fairly easy for governments and local communities to place significant pressure on those companies and halt or disrupt their production. I have published a major study on this topic. We are talking about hundreds and hundreds of millions of dollars lost when projects get delayed or stopped.

Okay, let's assume companies adjust and deploy more environmentally friendly and economically fair ways of mining. You mentioned that most of these minerals are easily renewable. So recycling is really the final objective?

DF: Sure, recycling is a big part of the planning for energy transition minerals. However, there is currently not nearly enough stock in the system. And when there is enough stock, sometime in the medium term, that stock will likely be in high-income countries. Low-income countries won't have access to that stock.

So access to recyclable material is the upcoming conflict the world needs to solve.

DF: Some people have been talking about the idea of minerals as a service. Producing countries rent or continue to get paid a royalty each time the mineral is transformed. This way, they can get back some value once it's continually recycled over time and in stock elsewhere.

MW: Going back to the biological perspective, we will run into regeneration constraints far before we run out of minerals. The limiting factor for accessing minerals is the energy it takes to concentrate and recycle them. And that energy is limited by how much biosphere we are willing to give up to make that happen. Again, we need to ask: What kind of service will be most valuable in the future? Companies using recycling and those that are providing the kind of service Daniel described will have a value advantage.

Do you think technologies could be developed that will not require this amount of lithium, copper and the like?

MW: I expect artificial intelligence to help us develop batteries that are much more recyclable and can use fewer fancy minerals and metals. That makes it even more difficult to project what kind of minerals may be needed in the future.

DF: Right. For example, researchers are talking about sodium batteries and other types of chemistries. And it's not just the technologies that will evolve, but also the way we plan our societies. For example, electrified mass transit would consume much less mineral resources than if we all drove individual cars. There would be a much lesser need for battery minerals.

Once we have built up stock and abandoned most mines, what will we leave behind at those sites?

DF: That's a huge priority in Australia where I'm located. Colleagues of mine have been visiting many sites to find out where there's value in the waste left behind. Extracting that value could turn up commodities we are looking for. At the same time, the revenue could be used to rehabilitate and restore those sites.

MW: Toxic waste legacies are a problem that needs to be addressed. But then, some of the most beautiful gardens I've seen are old quarries. It's possible. We just have to make the effort. ■

“This requires a mindset shift”

Raw materials are the starting point of our value creation, and we aim to use these resources efficiently and responsibly. At BASF we procure a number of mineral raw materials like palladium, platinum, cobalt or lithium to produce emissions catalysts, process catalysts or battery materials for electromobility, among other products. Of course, we are aware of the challenges in the supply chain. This makes the sensible resourcing of mineral raw materials highly important to us: When selecting suppliers and raw materials, we consider economic, environmental and social criteria as well as product safety and supply security alongside. We have adopted a specific due diligence approach and aim for third-party verification of our supply chains through independent industrial standards such as the Responsible Minerals Initiative. We are also collaborating with the Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation), which focuses on sustainable practices within artisanal mining. We also promote responsible sourcing through industry and multi-stakeholder initiatives, and dialogue with NGOs. At the same time, we are continually improving our products and processes to minimize the use of primary mineral raw materials.

With the new green transformation strategy, BASF underlines the importance of increasing circularity and reducing emissions. To keep minerals in the loop and thus slow down the exploitation of natural resources, we rely on the recycling of mineral resources. We are advancing innovative technologies for the recovery of metals such as lithium, nickel, cobalt and manganese from old lithium-ion batteries (see graphic on page 13). Moreover, we reduce the need for further mining by recovering metals from used automotive and industrial catalysts.

Our target is to generate a revenue of 10 billion euros from loop solutions by 2030 compared to 5 billion today. Loop solutions

include products that are based on renewable or recycled materials, or support the recycling process (close the loop) as well as products that increase the durability or prolong the lifespan of materials (extend the loop). Supporting this target, BASF teams are exploring more than 50 circular solutions in three areas: circular feedstocks, new material cycles and new business models.

An example of a circular feedstock is obtaining pyrolysis oil from old tires or mixed plastic waste. First, the recycled oil is fed into the beginning of our production process along with other feedstocks. Then the volume of recycled feedstock is attributed to a product such as a plastic for car parts or outdoor textiles. The recycled feedstocks and the attribution to our end products follow the requirements of mass balance certification schemes and are audited by independent third parties.

With the groundbreaking loopamid® project, we initiated a new material cycle by developing a novel textile-to-textile recycling solution for nylon-rich textiles. Together with our partner Inditex, we were able to design a jacket based entirely on textile waste from garments. It was launched by fashion retailer Zara in 2024.

A new business model is the mobile near-infrared spectroscopy solution for the identification of plastics to make them easier to sort. The portable handheld device makes it possible to determine different plastics prior to sorting. The solution was developed by BASF subsidiary trinamiX to ensure a clean plastics waste stream across recycling facilities, and combines mobile hardware, data analysis and material expertise.

These are important steps in the right direction. But the successful transformation towards a circular economy is only possible if we set up new economic systems together with partners in the various industries. This requires a mindset shift from thinking in value chains to acting in value circles. ■



Talke Schaffranek is Director of Circular Economy at BASF, Ludwigshafen, Germany. Her previous responsibilities include applied sustainability, business development in Asia, diversity and inclusion, and product management. In her spare time, Schaffranek runs an association that works to empower women in Nigeria, among other things.

“To keep minerals in the loop, we rely on recycling.”

Photo: BASF SE



Error 404: advocating for fair AI

ILLUSTRATION
Edward
Carvalho-Monaghan

In 2020, at the height of the covid-19 pandemic, I became an Artificial Intelligence (AI) justice advocate. Not by choice, nor due to my academic pursuits in computer science at the time, but because a mandatory facial detection algorithm failed to recognize my face. The online, at-home examination software implemented by my university was unable to detect students with darker skin tones. As a result, I faced delays and obstacles entering my exams, unlike my white peers. This compelled me to report my unfortunate and, one could say, hurtful experience to the university, especially as reports claimed more students worldwide were encountering the same issues.

After running through several hoops (and months) to find the correct university office to report the issue to, the university decided against honoring my request to cease the use of the online exam software. I have since made it my mission to fight for fair and just algorithms, and alter the way organizations, governments, and the private sector look at implementing these systems. In 2022 the Netherlands Institute for Human Rights ruled in an interim judgement that I had provided enough evidence to suggest algorithmic discrimination had occurred. However, after the university had provided counterevidence, the Institute concluded in October 2023 that although the specific software might be discriminatory, it had not been conclusively proven that discrimination took place in my particular experience.

Datasets trained to establish our AI models have been shown to favor the reality of wealthy, European and North-American perspectives. This perpetuates race and gender stereotypes, which negatively affects systems combatting these inequalities. For example, text-to-image generators prompted to produce images of people in various occupations, yielded images of white males for high-income occupations and images of darker-skinned females in the low-income occupation category.

Additionally, AI can perpetuate gender bias in recruitment. This was exemplified by Amazon's AI-driven hiring model, which favored male candidates for technical roles due to historical data reflecting gender imbalances. This bias further highlights the need for transparency and fairness in AI systems to prevent discrimination and ensure equal opportunities for all candidates.

“The answer to fair and just algorithms does not only lie in more diverse datasets.”

The prevalent solution proposed to address AI bias is to diversify the datasets used to train these systems. I believe that while these calls for more diverse datasets are well-intentioned, they are insufficient. We must adopt a different perspective that fundamentally rethinks AI development. This reimagining of AI development requires prioritizing justice and equity over mere technological capability.

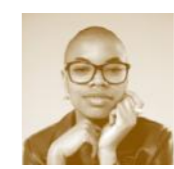
I am often invited by companies and organizations to share my expertise on this ethical AI perspective. The solutions I propose to the growing bias in our decision-making models can be achieved at the developer's desk and in the boardroom, as they take both the technological and organizational aspects of dealing with AI into account. What I find most important is to put visibility on the impact of AI, which often remains hidden from public view and can potentially create unforeseen ramifications.

Firstly, empowering communities to collect, own and manage their own data can ensure that AI systems reflect more diverse realities. Localized data governance, where communities set the terms for data collection and usage, can prevent exploitation and misrepresentation.

Secondly, implementing regular bias audits and establishing accountability mechanisms can address the ethical shortcomings of current AI systems. My case with the facial detection software is a prime example of this. If users cannot adequately escalate their (negative) experiences with AI, the entity that acquired and implemented it cannot be held accountable. This is especially problematic when these “system says no”-decisions cannot or can hardly be disputed.

Lastly, shifting the focus from purely technological metrics to equity-centred metrics can ensure that AI systems prioritize equity and fairness at the same level as the quantitative parameters. Examples of equity-centred metrics include fair working conditions at data centers, which often employ people from marginalized communities, and insight on environmental impact. The success of an algorithm should be measured not just by the direct output you see on the screen, but by its fairness, representation and proper consideration. This approach requires a fundamental shift in how we think about AI, moving from a focus on technical prowess to include ethical responsibility and social justice. The way we build the system, and who benefits and is exploited in its development, is going to be extremely important. ■

Photo: Bete Photography



ROBIN POCORNIE
is a driven scientist and professional speaker in the field of technology and ethics and advises various organizations on the responsible use of algorithms. She is also the first person in the Netherlands to have generated case law on algorithms and discrimination.

Malaria cases worldwide have not declined as many hoped. In some areas, they are even increasing. Still, expert Justin McBeath remains optimistic.

PHOTOS David Vintiner
TEXT David Gilliver



“We can do this”

A

According to the World Health Organization, there were almost 263 million malaria cases in 2023 – an increase of 11 million on the previous year – and nearly 600,000 deaths. Although insecticide treated nets and insecticides have had huge impact in tackling the disease, one reason malaria is proving so difficult to control is that the Anopheles mosquito, which transmits malaria, is extremely adaptable.

Justin McBeath, CEO of the Innovative Vector Control Consortium (IVCC), has spent 25 years in the fight against malaria. The U.K. national explains the challenges and opportunities, and what keeps him motivated in the ongoing battle to eliminate the disease.

Two malaria vaccines for children were approved in 2023, and others are currently being developed. Does this mean the fight against malaria is over?

The current suite of malaria vaccines is going to play a really important role in reducing the number of deaths from the disease, but the vaccines don't prevent malaria transmission and its other effects. So there is a continued need for other tools. The concept of an integrated approach – different tools being deployed together – is really important, as these vaccines are not silver bullets. If we get to a point where there's an effective transmission-blocking vaccine, then that might significantly change the dynamic. But that's likely to be some time away.

So it's not a case of vaccines taking the place of insecticides – we'll always need both?

Ultimately, they're complementary. Countries need the availability of a toolbox of effective options, also including drugs and diagnostics, and they need funding support to deploy a mix of locally appropriate tools. We therefore need data and evidence to support where, when, and how they should be deployed alongside each other. And that's all in a resource-constrained environment. It's really important for there to be a range of tools for countries to choose from to match their needs.

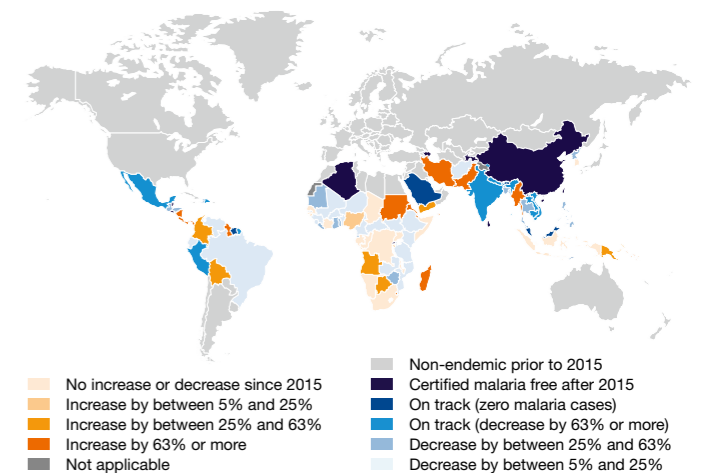
What are the most effective preventive measures?

Of the reduction in malaria prevalence that occurred between 2000 and 2015, 78 percent was attributable to insecticide-based interventions – nets and indoor residual spraying (IRS). The biggest part of that was insecticide-treated mosquito nets (ITN), so it's likely that trend will continue. But it's not a static situation. There are dynamics to take into account – resistance, outdoor transmission, drug resistance, climate change and others. The situation with resistance is evolving, so having some new modes of action on nets is going to be extremely important in maintaining effectiveness. But nets and IRS don't address all the challenges of outdoor transmission, so other tools are also going to be needed.



Hope exists: Between 2000 and 2020, the percentage of the entire at-risk population sleeping under an ITN increased from 2 percent to 43 percent.

On track?



Malaria-endemic countries and their progress towards the GTS* 2025 milestone of a 63% reduction in malaria cases from a 2015 baseline.

*GTS: Global technical strategy for malaria 2016–2030. Source: WHO estimates 2024

After years of progress in tackling malaria, infection rates are on the rise again. Why is this?

It's partly a legacy of covid-19 and the disruption to countries' health systems when resources were diverted, then there is the pervading challenge of resistance to drugs and insecticides as well as the ever present issue of funding constraints and ability to reach coverage targets. There will always be funding constraints. They limit what tools and interventions malaria programs can procure.

How do you see the situation developing over the next few years?

I think there are going to be continued challenges, at least in the area of vector control. There are some positives in terms of new insecticides, which are likely to become available in the next five years – innovations that should help with addressing the resistance challenges, but we are operating in a biological environment – things are never static. The availability of vaccines also creates questions of how to generate the necessary data to support decision making when there are more tools available. But that's not such a bad challenge to have.

Is the international community committed to fighting malaria?

Justin McBeath joined the Innovative Vector Control Consortium (IVCC) as CEO in 2023. IVCC is a not-for-profit, public-private partnership working together with industry, the public sector and academia to facilitate the development of novel public health insecticides against insect-borne diseases. McBeath worked in various international leadership positions related to the development, registration and marketing of mosquito and other pest management solutions. He holds a bachelor's degree in agricultural zoology and a master's in medical entomology.

All the organizations we engage with, whether it's the country programs, the WHO or the Bill & Melinda Gates Foundation, are doing a fantastic job and are fully committed. But malaria is one health challenge among many – there are also massive challenges with tuberculosis and HIV, and of course the Global Fund finances the fight against all three. For them, prioritizing resources across three diseases is a high-level challenge before we even get into the nitty-gritty of malaria itself.

How likely is climate change to push the disease into new regions?

Rainfall, temperature and mosquitoes go hand in hand. For example, there was a rapid upsurge in malaria cases following devastating floods in Pakistan in 2022. With climate change, there's some logic to say where it gets warmer and there's greater capacity for mosquitoes to breed that's likely to increase the threat. But only if malaria is already spread in the population, because the mosquitos are the vector, not the origin of the disease. That's why a growing mosquito population doesn't necessarily mean more disease.

You've been working in this field for 25 years – what inspired you to focus on malaria?

I'm fundamentally a biologist by training, by education, by interest. Even as a kid I was into bugs and animals and spent a lot of my time outside. I've always had a fascination with tropical diseases, alongside a personal belief in doing something that leaves the world in a better place. At university I was inspired by a lecturer who presented his work on an onchocerciasis ("river blindness") program in West Africa. It convinced me that I wanted to do something like that – a mix of science, tropical disease and helping people. And then, when I did my M.A., I had the opportunity to work in West Africa as part of my research on insecticide-treated mosquito nets. I saw the impact the nets were having.

When do you think malaria might finally be eliminated?

We're seeing a slow but steady increase in the number of countries where malaria elimination has been achieved. Some of those are smaller countries, which makes it easier, but I personally would see it to be a significant achievement if by 2040 the map could be constricted to just a handful of major-burden countries. There are still massive-challenge countries like Nigeria, the Democratic Republic of the Congo or some of the central African countries. It's encouraging that there's progress being made each year. But the only way we're going to get there is by using that range of different tools, deploying them in a way that's evidence-based, and with resource and investment behind them.

Working in this field must be harrowing at times. What motivates you to keep going on a day-to-day basis?

I've never not been motivated. I certainly believe that we will ultimately achieve elimination of malaria – you've got to hold on to that. As a CEO I have a responsibility for the motivation of our employees, who are equally committed and passionate. And I really do fundamentally believe that we can do this. ■

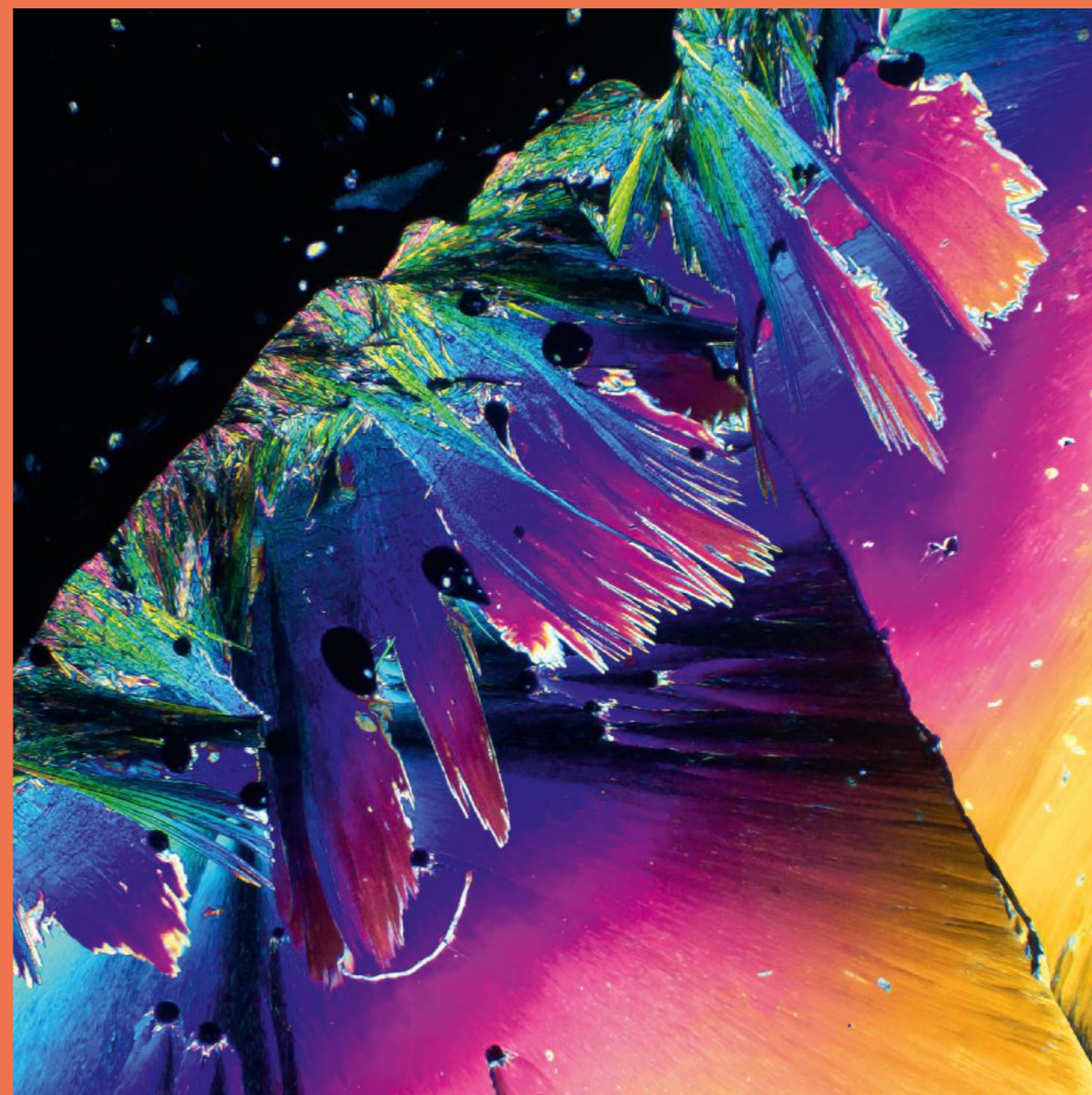
“Countries need effective options and funding to deploy a mix of locally appropriate tools.”



In partnership with the Liverpool Insect Testing Establishment (LITE), McBeath and his team are always on the lookout for innovations to combat malaria.

Life-saving nets

When cases of malaria increased around the world – due largely to mosquitoes' resistance to common insecticides – BASF developed the Interceptor® G2 (IG2) insecticide-treated mosquito net. IG2 kills resistant mosquitoes using chlorfenapyr, a new class of insecticides for public health. With support from partners like the Gates Foundation and MedAccess, over 100 million IG2 nets were delivered to malaria-affected countries in 2024. BASF is currently innovating to develop next generation Interceptor nets.



Microscopic image of the insecticide chlorfenapyr.

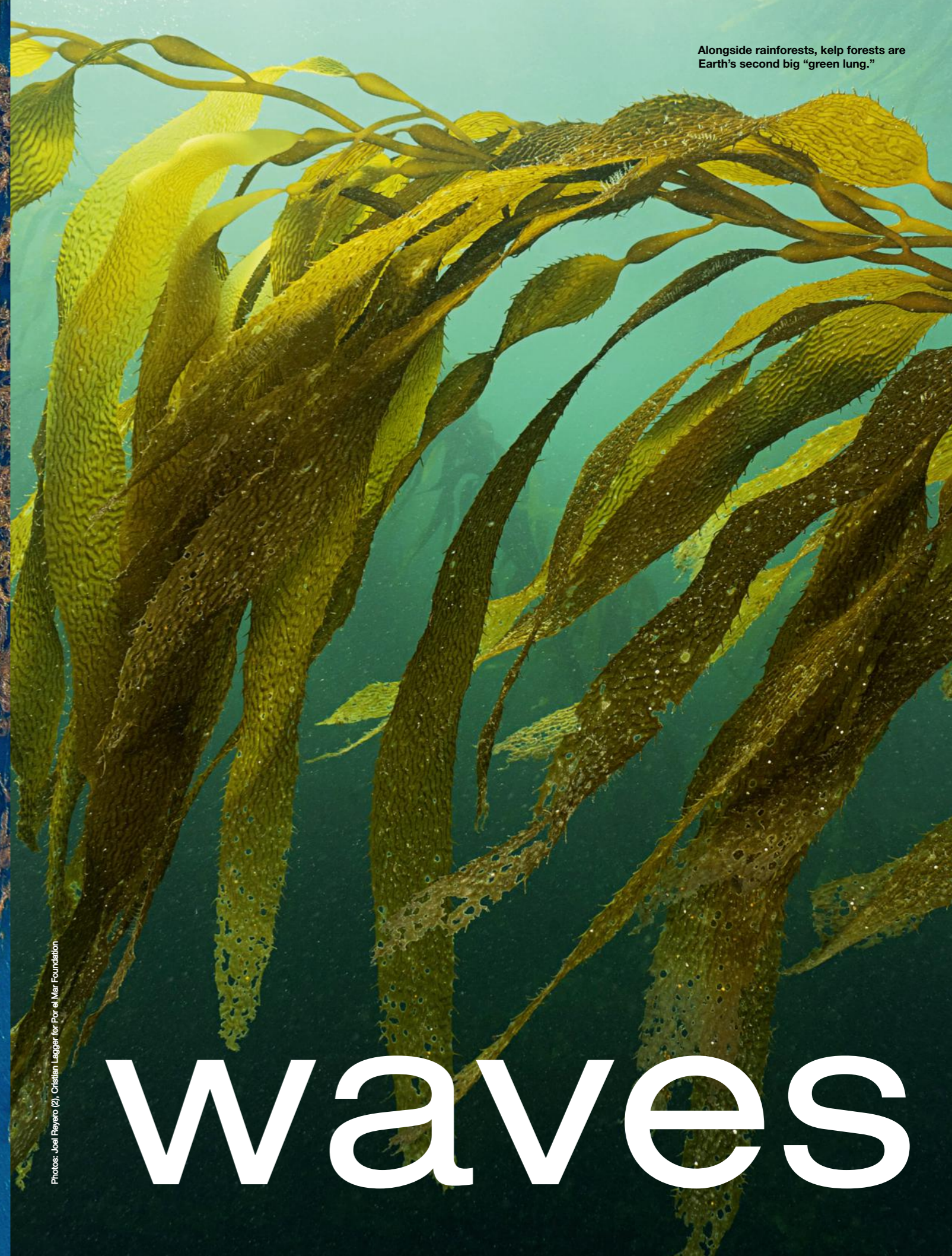
Martu



TEXT
Nele-Marie
Brüdgam

makes

Alongside rainforests, kelp forests are Earth's second big "green lung."



Photos: Joel Reyero (2), Cristóbal Laguer for Por el Mar Foundation

waves

Argentinian environmental activist and marketing expert Martina Sasso is revolutionizing marine conservation in her home country through her NGO Por el Mar. Read on for a profile of a true visionary and pragmatist – and a woman who is tireless in her pursuit of success.



Martina Sasso
Born and raised in Buenos Aires, Sasso went to Costa Rica at the age of 19, where she ran a beachfront restaurant. Back home in Argentina, she studied advertising and cinematography and went on to pursue a career as a creative director at an advertising agency, before switching to working full-time for the environmental organization Rewilding Argentina in 2017. In 2022, she established the marine conservation organization Por el Mar. The 38-year-old has a son, and her hobbies include sailing, surfing and playing the guitar and drums.

As recently as a few years ago, marine conservation was not an issue in Argentina. Marine protected areas existed, but they were few and far between, and tended to be small. Salmon farming was big, despite the detrimental environmental impact, and kelp forests were cleared to make way for more farms. Yet as a vehicle for carbon sequestration, these underwater ecosystems are just as crucial as tropical rainforests.

Enter Martina Sasso.

Since 2017, she has dedicated herself full-time to marine conservation. Now, huge stretches of water around Argentina's southern shores are under conservation protection, putting a stop to the uncontrolled destruction of the kelp forests. Argentina was also the first country in the world to ban ocean salmon farming by law. Without Martina Sasso's work, this would not have happened – or at least not so quickly. But her achievements don't stop there.

Thirty-eight-year-old Martina Sasso from Buenos Aires is a movie director and communications expert by training, and an experienced advertising and marketing specialist. She is also the founder of the marine conservation organization Por el Mar (which means "For the Sea"). She heads a team of 38 employees, around three quarters of them women, and serves as a point of contact for Argentina's provincial governors and federal ministers. Martina's pragmatic approach to marine conservation has proved effective, but she is also something of a visionary:

"Most of our planet's biodiversity has been lost within the last hundred years or so. The rich variety of our flora and fauna has diminished. But I believe that we can regain what we once had. There's still enough time for us to make changes." To achieve this, she works 60 hours a week, or even more.

Martina turns up for our Zoom interview promptly at 1 pm Argentinian time, and immediately offers an apology: "I've been doing interviews all

"I feel a deep empathy for the creatures of the ocean."

morning, would you mind if I just make myself a cup of tea?" Of course not! Six minutes later, she is back and ready to get started. She's wearing a fleece sweater with a multicolored pattern that echoes indigenous South American motifs. The label bears the name Patagonia – surely no coincidence: The clothing brand's founder, Yvon Chouinard, is also a keen environmental activist and his company is a key sponsor for Por el Mar. Martina has made a cup of traditional mate tea, which she drinks in proper South American style through a metal straw. When we begin our conversation, her very long, dark hair, gathered up in a bun, is so irrepressibly shiny that it reflects the optimism, joy, and vivacity she herself radiates – even when broaching serious and complex topics. It's almost as if she has her own internal solar power generator, complete with batteries for perpetual energy, requiring only light and air to generate incredible dynamism, ideas, and creative drive.

"I'm a workaholic," confesses Martina, who is known as Martu to virtually everyone, from colleagues to top politicians. She usually works from 8 in the morning to 8 or 9 at night, but only from Monday to Friday. Her weekends are reserved for family, which means herself and her young son. "I got married seven years ago and our son Beto was born three years ago, the same year my husband died," she continues, "A year after that, I set up my organization Por el Mar. It all kind of happened at once." What drives her? "I love nature. I feel connected with it. This connection gives me strength. I love the sea; that's my great passion. I'm a sailor and a surfer, and I feel a deep empathy for the creatures of the ocean." This empathy is something many people lack. They know that if the oceans were to disappear, the history of humankind would abruptly come to an end, but there's no sense of emotional affinity. The activist realizes that this applies to many people, including in Argentina: "The sea is an important economic factor since we export 95 percent of what we extract from it. But Argentina isn't doing much in the way of marine research." For some reason, the ocean doesn't seem to attract much interest. In an effort to change this, Por el Mar organizes swimming and standup paddleboarding courses in



One of the most remote places on Earth and a passion project for Martina Sasso, the Mitre Peninsula spans 790,000 hectares at the easternmost point of the province of Tierra del Fuego ("Land of Fire") in Argentina. Its extensive coastline is home not only to a wealth of flora and fauna, but also to vast kelp forests – sensitive ecosystems in urgent need of protection.

Photos: Joel Reyero



Por el Mar is trying to get another 180 square kilometers declared a marine protected area in southern Argentina. This would preserve important kelp forests, which store huge quantities of CO₂ and provide a habitat for many sea-dwelling species.

Photo: Carolina Pantano

coastal locations. These are one of the four pillars on which the organization's success rests. Martina calls this first pillar "Community stewardship." Unlike many other NGOs, Por el Mar doesn't deploy environmental educators; instead, it has its own staff based in the places where there is potential to make a difference, and a need to do so. These local experts work with people in their own neighborhoods to develop programs and activities designed to raise awareness of oceans and teach them why they need to be protected. Their project offers diving courses for children, community beach cleanups, workshops and group wildlife observations.

Por el Mar's second strategic pillar involves science, research and practical marine conservation measures. For instance, it employs scientists to map important but uncharted areas beneath the ocean's surface. It is also currently working on a project to restore kelp forests. The NGO's third pillar is lobby work. "We approach local and regional politicians, we go to the National Congress, we talk to everyone," says Martina. The final crucial factor in the organization's success – the fourth pillar – is public relations. As Martina points out: "We have a great communications team." In 2024, for example, Por el Mar released "Pyrifera," a short film about marine life in the Patagonia region. This prompted a campaign to light up public buildings in blue on the evening of June 8, which is when the United Nations marks World Oceans Day.

Thanks to these four pillars, it rarely takes Martina more than two or three years to achieve her project targets: getting a new law passed, for example, or having a new section of ocean designated a marine protected area.

It was a miss rather than a hit that kick-started Martina's career as a marine activist. In her twenties, she worked as a creative director for a big advertising agency. Her job involved giving strategic advice to major companies. "I decided to do the same thing in my free time too," she recalls, "South of Buenos Aires there's Mundo Marino, a marine park with an aquarium where a solitary orca, Kshamenk, lives in a small tank. There are dolphins there too, to keep the visitors entertained. I felt terribly sorry for these creatures." At the time, activists were protesting animal cruelty and spray-painting accusations like "Orca murderers!" on the walls, but nothing changed. So, Martina targeted the managers instead: "I wrote an email saying 'What can we do to help your park get by without any large marine animals? Times are changing and people don't want this kind of thing anymore. You need to plan for the future, otherwise you could soon be facing the threat of closure.' They invited me to come and talk to them and we started working together. I contacted Disney's management and found out from them how a great park could be run without animals. For six months, I was working at the advertising agency by day and slaving away like crazy every evening for Mundo Marino, for no pay." At the end of those six

"I'll carry on. And I'll put all the strength I have into it."

Kelp forest project



months, the pivotal moment came. "It was during a board meeting," Martina recalls, "They looked at me and said 'Martu, you know what? Your ideas and plans are wonderful, but we make good money by doing things the way we do now. We don't need to change anything.'" On the journey back – it was four hours' drive each way – she wept tears of anger and disappointment – but not of despair. By the time she got home, the decision had been made: "I'll carry on. And I'll put all the strength and dedication I have into it." So, she quit her job at the advertising agency and started working full-time in marine conservation. In 2017, she was put in charge of the Marine Program at Rewilding Argentina, a major organization. Then in 2018, she founded the worldwide Global Salmon Farming Resistance initiative. In 2022, she launched Por el Mar, an NGO that now has an annual budget of two million U.S. dollars – just from donations from businesses, foundations and partner organizations.

Martu stepped down from Global Salmon Farming Resistance last year: "It became too much for me. But what I am good at is this: finding the right people and putting teams together." Salmon farming may no longer be an issue in Argentina, yet there is still plenty of other work to be done. Por el Mar has set up a research laboratory, for instance, where biologists in collaboration with international researchers are experimenting with cultivating algae to repopulate the underwater kelp forests. The next big project involves protecting sharks. "Argentina has lost 80 percent of its shark population," Martina explains, "People hunt them as a hobby and kill them for fun. It's a popular weekend pastime, but the dead sharks are just left to rot." Now, Por el Mar is aiming to set up shark reserves and encourage people to rediscover the emotional connection with the sea and its wildlife they once had. After all, it's our nature. ■

Hi-tech heroes



1 SHINING EXAMPLE OF INCLUSION

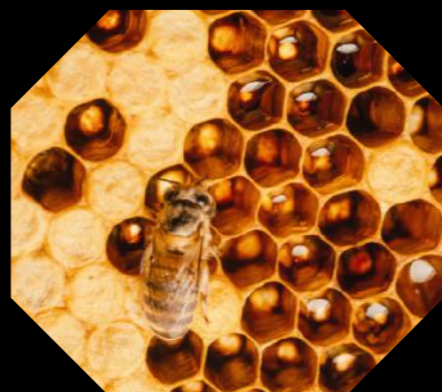
For many people in Japan, robots are part of everyday life. Yet even in this robot paradise, OriHime-D is turning heads. As it makes its way around Tokyo's Café Dawn, this robot, along with its col-

leagues, is controlled remotely by people with limited mobility, from their own home. They chat to the guests and take orders, which are served by their robot avatar. OriHime-D, who has glowing eyes and bears a passing resemblance to an alien, was designed to promote inclusion. Thanks to the robots, the café has created around 50 jobs for people who would otherwise struggle on the employment market and are often isolated due to illness.

Robots are helping to save the rainforest, enabling greater levels of integration in society and can even handle queen bees. Here are five innovative ways robots are helping us.

2 THE ROYAL TREATMENT

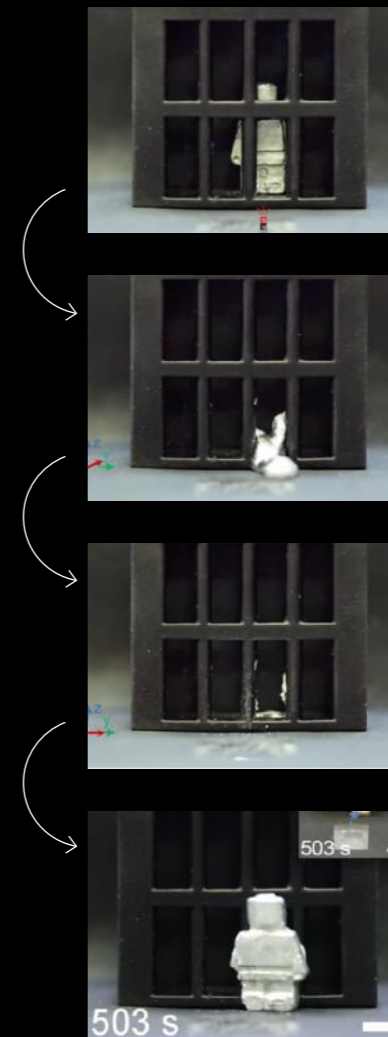
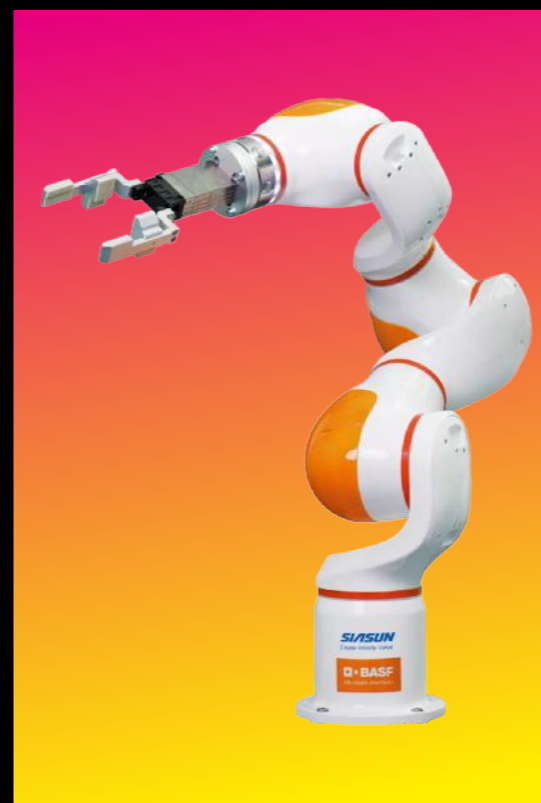
Bees are indispensable for agriculture, with around a third of our crops dependent on them as pollinators. A research team at the University of Durham in the U.K. developed the RoboRoyale project to provide ideal conditions for queen bees and ensure egg production. In a replica of the royal household, six to eight robot bees per hive look after the queen by bringing her the right food at the right time, grooming and cleaning her and passing pheromones from the queen back to the bee colony. Pheromones are important messenger substances that she uses to influence the behavior of her worker bees, and prevent them, for instance, from laying eggs. Some of the tiny robots are fitted with micro-cameras, allowing researchers to study bee life inside the hive.



Photos: OriHime-D/Ory Laboratories, Pansun Images/Stocksy, BASF SE, Matter/Chingyuan Wang/Changfeng Pan/Yuand Zhang/Lulun Peng/Zhipeng Chen/Carmel Majid/Lulun Jiang, ABB Robotics/Junglekeepers

3 SHOULDER TO SHOULDER

There is no need to be afraid of contact here: Collaborative robots – known as cobots – are industrial robots that meet certain safety requirements and can therefore work safely with humans. They are now used in numerous industries to assist with monotonous or strenuous tasks, from welding to lifting baking trays in bakeries. This poses great challenges when it comes to materials. Together with SIASUN, one of the largest robot manufacturers in China, BASF has developed plastics especially for cobots that are heat-resistant and robust and have reduced cobot weight by 35 percent compared to metallic materials. This makes the cobots more agile and energy efficient. Human safety is also improved as shocks are cushioned, and the robots are particularly well insulated.



4 SHAPE SHIFTER

Remember the T-1000 robot from the 1991 movie "Terminator 2" that could change its form from solid to liquid and back again to overcome obstacles? A metallic miniature robot developed by a team from China and the United States can replicate this ability. The robot is solid or liquid depending on requirements; it is also magnetic and capable of conducting electricity. Flexible robots like these could bypass the disadvantages of their counterparts made exclusively from hard materials, which are too rigid, or robots made of soft materials, which are too weak. In practice, they could help deliver medication precisely in the human body via magnetic controls. They could also remove foreign bodies that have been swallowed by wrapping themselves around the item and transporting it out of the body.

5 PLANTING THE JUNGLE

The Amazon rainforest, the world's green lung, binds vast amounts of carbon. Yet deforestation is steadily eradicating its area. The Peruvian nonprofit organization Junglekeepers and the Swiss-Swedish company ABB Robotics aim to do something about this and are reforesting 22,000 hectares of rainforest with the aid of a robot. This robot, called YuMi, does the time-consuming and laborious work in the Peruvian jungle, such as sowing seeds in boxes where the trees will later germinate – work that was once done manually by volunteers. With YuMi's help, Junglekeepers can plant an area the size of two soccer fields every day.





Take your time

Everyone wants to live a long life – preferably without the visible signs of aging. Since the dawn of time, humans have pondered the mystery of why we age. Modern science is starting to decipher the biochemical mechanisms behind this process. At the center of this research lies epigenetics – the field of biology that studies how genetic activity is regulated. How do these processes contribute to aging? And, perhaps more importantly: Can we slow them down or even stop them?

Forever young? Scientists are developing methods that can slow down and even reverse the aging process.

TEXT
Marlene Heckl

PHOTOS
Philotheus Nisch

J

Jeanne Calment was a constant source of astonishment to those around her: The French woman took up fencing at the age of 85, she was still riding a bicycle at the age of 100 and she walked everywhere, attributing her enduring fitness and vitality to all these factors. It truly was enduring: When Calment died in 1997, she was 122 years old, making her officially the oldest person who ever lived.

So, what was her secret? What is it that keeps people fit long into old age and how can we utilize this knowledge? Scientists around the world are grappling with questions such as these. To answer them, it is first necessary to decipher the aging process.

For a long time, it was assumed that aging was mainly caused by mutations in the genes. Over time, these minute changes in the DNA code can disrupt the normal functions of the cells and ultimately cause cell death. The fewer functioning cells we have in our body, the frailer and sicker we become, rather like a car that stops working because of the wear and tear on its components.

But there are animals and people who remain fit and healthy despite these mutations, in many cases appearing much younger than their actual age. This led scientists to conclude that there must be another mechanism at play that influences how we age.

In the 1940s, the British professor Conrad Waddington dedicated himself to this emerging field. Called epigenetics, it focuses on gene properties that come not from the DNA but rather from chemical tags attached to the genes. To illustrate this concept, picture our genes as a collection of books in a library. Some books are marked with small notes – corresponding to the biomolecules – that determine whether a book is being read (gene activated) or not (gene deactivated). These markers are referred to as the epigenetic code. The specific epigenetic code that is established in an individual and whether it changes over a lifetime is defined by the body's own signaling chemicals and by environmental influences. From air quality and nutrition to stress, exercise and even trauma, these and other factors can trigger biochemical changes and result in corresponding tags on the DNA. With the help of epigenetics, scientists can explain why, for example, only one of two identical twins develops a disease like diabetes; in other words, what activates or deactivates the corresponding genes in only one twin.

A new age

In the United States in 2013, working in his lab at the University of California in Los Angeles, Dr. Steve Horvath discovered that many of the markers systematically change their position as people get older, switching certain genes on and switching others off. Based on these changes, he established the first procedure for determining a person's biological age. Known around the world as "Horvath's clock," it uses an algorithm to determine the vitality of an organism, or its "true" age, which does not necessarily have to correspond to its age in years. Horvath's mathematical model uses certain epigenetic methylation markers (see infographic) to predict a person's age: At 50, have we already aged an extra ten years? Or do we have the cells of a 40-year-old? According to the scientist, the blood tests have an accuracy of around 3.6 years. ▾

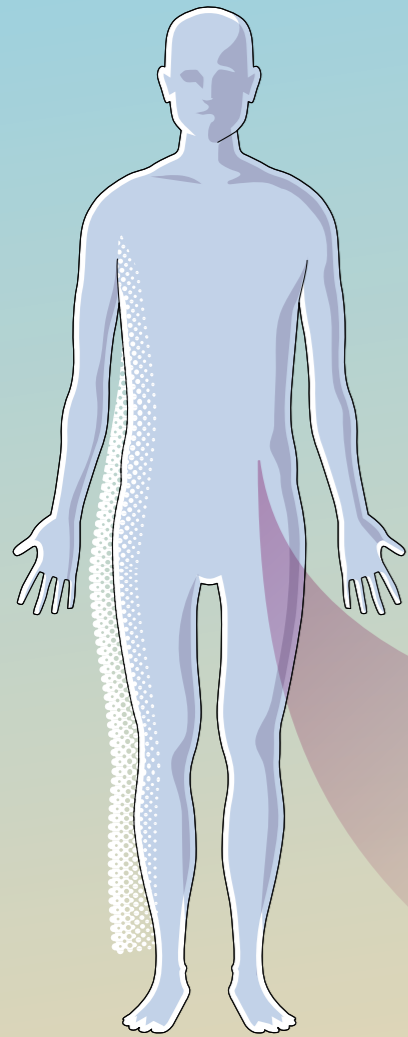
Your "real" age doesn't have to match your age in years.

Gotcha! New research shows there is a good chance of capturing time. According to the latest findings, it's not just our genes that are responsible for aging, but also how we live – and what we experience.

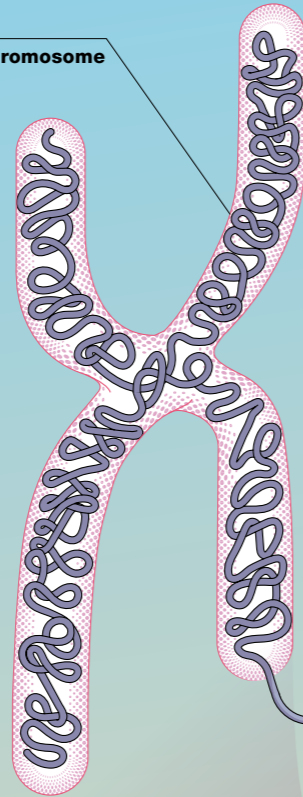


WHAT IS EPIGENETICS?

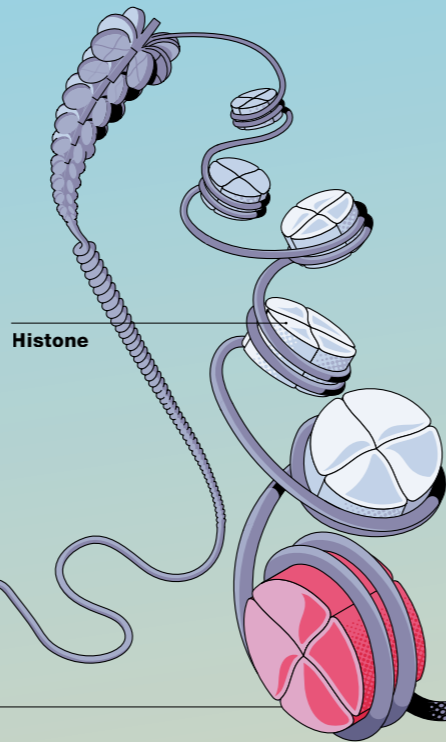
A human being has around 25,000 genes, which are not all active all the time. Chemical processes in the body can switch them on or off. Possible triggers can include stress or diet.



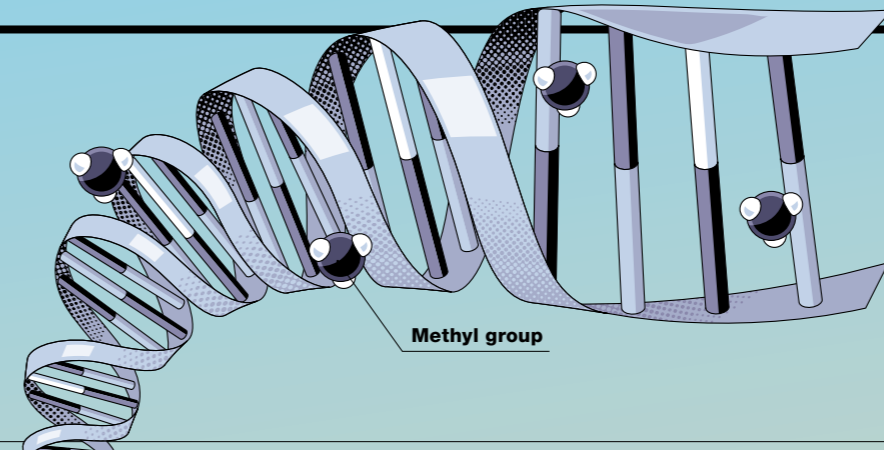
Chromosome



Histone



Methyl group



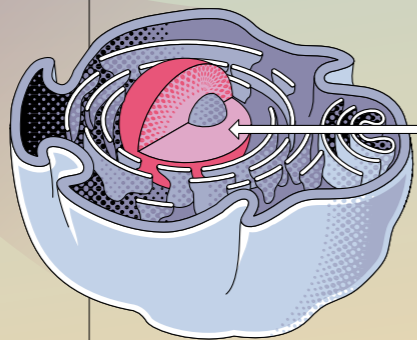
TO BE OR NOT TO BE

Each of the individual blueprints for an organism is stored in a specific part of the DNA, the gene. But not all genes are active. Which genes are activated, or which blueprints dictate the production of proteins, enzymes, hormones, etc., changes throughout a person's life. Genes are deactivated by chemical processes such as DNA methylation: Small molecules that consist of one carbon and three hydrogen atoms attach themselves to certain genes and deactivate them.

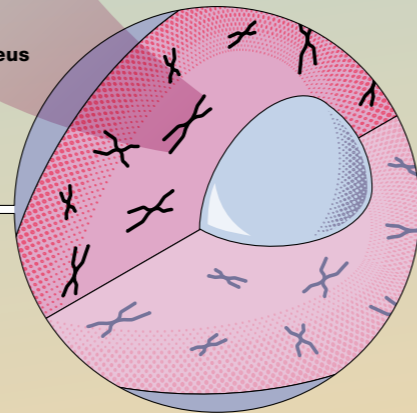
A QUESTION OF GENETICS

Our genetic material, deoxyribonucleic acid (DNA), is found in the nucleus of each cell in the body. It is distributed over 46 chromosomes. If these were pulled apart and laid end to end, they would stretch out to six feet. The DNA is coiled around proteins called histones, so it can fit into the tiny cell nucleus.

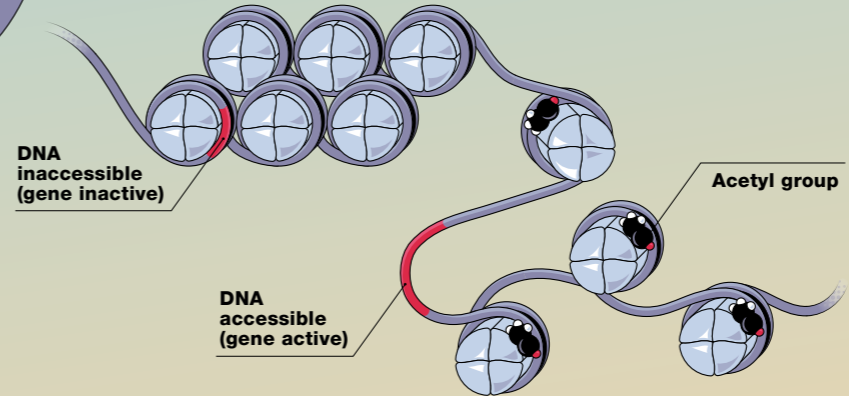
Cell



Cell nucleus



DNA inaccessible (gene inactive)



Acetyl group

DNA accessible (gene active)

GENE ACTIVATION THROUGH ACETYLATION

Other markers, in turn, can activate genes: Small molecules called acetyl groups are attached to the DNA during acetylation. This releases the genes from their histone wrapping, making the DNA accessible and able to be read.

Since then, other epigenetic clocks have been discovered as well. Some show the age of a specific organ, others are even said to predict a person's approximate end of life. "Yes, that sounds scary," Horvath admits. "But this kind of information can be an incentive to make a change in your life."

It is possible to influence the methylation patterns, giving us a chance to slow down or even turn back our epigenetic clock. Studies show that a diet rich in fruit, vegetables, fish and healthy fats can switch off genes that speed up aging. The biological age of participants who followed the Mediterranean diet was

The aging process was actually reversed.

Illustration: Manuel Bortolotti

on average 18 months younger than that of those whose diet contained animal-derived proteins and fats, and foods containing sugar. Sufficient sleep and regular exercise also have a positive effect.

The science of youth

Professor Vittorio Sebastiano from Stanford University in the U.S. was able to pinpoint other ways in which aging could be slowed down by harnessing mRNA technology to potentially extend our lives. Messenger ribonucleic acid (mRNA) is inside every cell in our bodies. This messenger molecule transports genetic information from the cell nucleus to the parts of the cell where proteins are formed. The researcher injected prematurely aged mice with an mRNA blueprint for a specific repair protein. This enters the cell, where it can mend the epigenetic markers in areas that have been altered over time. In Sebastiano's experiments, the muscles and eyesight of weakened and blinded animals were restored. The process even offered a way to rejuvenate human skin, muscle and blood cells – by between one and a half to three and a half years.

Similar results emerged from a study conducted in the U.S. by Dr. Greg Fahy and Robert Brooke, whose biotech company Intervene Immune is a pioneer in biological rejuvenation. The scientists used an experimental anti-aging mix to treat nine men ages 51 to 61 over the course of a year and then analyzed their blood with Horvath's epigenetic clock. The result: From a biological perspective, the men were on average a year and a half younger after the treatment than when they started, which means that their aging process had not just been slowed, but was actually reversed.

These results were due to a mix of three components: the human growth hormone HGH, the sex hormone precursor DHEA and the diabetes drug Metformin. This combination stimulates the growth of the thymus, the part of the immune system that usually atrophies in older people and is no longer active. In young people, however, the immune organ beneath the breastbone helps to prevent inflammatory processes that accelerate cell aging and diseases.

"We were able to reproduce the rejuvenating effects of the treatment on the immune system in the larger TRIIM-X study and also reverse biological age," Brooke explains. The reproducibility of the results still needs to be tested in larger studies, but the scientists have taken a major step forward.

This means that living longer – while remaining healthy and fit – is no longer a utopian dream. Epigenetic research is progressing rapidly and delivering new methods to reverse cell aging. Someday, it may well unlock the key to the long life of people like 122-year-old Jeanne Calment, whose own explanation for her longevity was a little less scientific: "God simply forgot about me."

From pineapple leaf to citrus peel: Things regarded as trash are often far too good to throw away. We reveal how seemingly unusable by-products can be turned into valuable raw materials.

Wonderful waste

PHILIPPINES, SPAIN As well as being an eye-catcher for special occasions, the Philippine national costume is also made from a special material: It is woven from the cellulose fibers of pineapple leaves, an abundant resource in the island country. Spanish designer Dr. Carmen Hijosa loved the idea; she developed the process further and now offers an alternative to leather made from pineapple leaves, which farmers would otherwise discard. Founded in 2010 with the help of a mortgage on her house (as investors were initially skeptical), her company Ananas Anam now sells products made from the patented Piñatex material worldwide. Customers include H&M, Nike and Hugo Boss.

Pineapple apparel



Carved from a different wood



GHANA Wood is a sought-after building material. Yet increasing deforestation is threatening forests all over the world. In its search for an alternative, Ghanaian company Ecovon came upon coconut waste. Around 750,000 metric tons of it are produced each year in Ghana alone. The outer, fibrous shell of the coconut has a high lignin content, just like wood. This natural substance reinforces the plant cell wall and ensures stability and longevity. By combining it with bagasse – the fibrous residue of the sugar cane plant – and thereby eliminating the need for glue, a durable alternative to wood-based materials such as chipboard can be produced. Ecovon is not only aiming to reduce deforestation with its approach, but also intends to improve the lives of people in coconut and sugar cane growing regions by creating an additional source of income.



Coffee rocks

GERMANY From plant fertilizer to cosmetic exfoliants, coffee grounds can be made use of in many ways. With the help of BASF polymers (specifically designed macromolecules), they can also be transformed into stable materials and incorporated into floor coverings, furniture, handbags and even musical instruments. BASF joined forces with the companies ChopValue and 21upcycling to develop materials from industrial coffee grounds, recycled chopsticks and shredded jeans, which can be used as components for electric guitars. The coffee-based Elektra model by guitar maker Stefan Richter from the German town of Schwetzingen serves up a rich acoustic bandwidth ranging from “sweet” to “shrill,” and the design features coffee beans.

Curing with cod



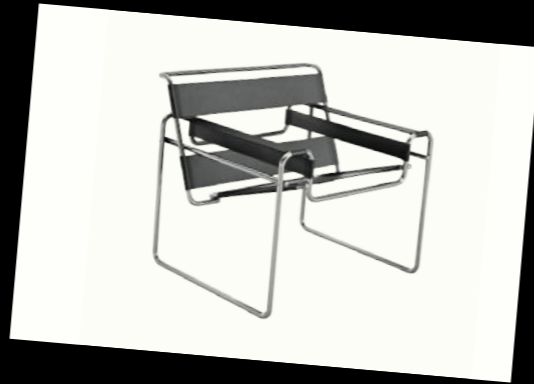
ICELAND Healing chronic wounds using fish skin that transforms into human skin... Sounds like magic? It isn't. In Iceland, which most recently exported around 130,000 metric tons of cod annually, the company Kerecis uses leftover cod skin to produce special bandages that are suitable for slow-healing burns or large-scale diabetic wounds. Fish skin contains lots of collagen, an important building block for skin and bone, and plenty of polyunsaturated omega-3 fatty acids, which have an anti-inflammatory and antibacterial effect. Once the bandage is applied to an open wound, the body's own cells grow into the fish skin and transform it into living skin tissue.

Appealingly clean



BRAZIL Manufacturers are increasingly using natural ingredients in cleaning products, with one exception: Preservatives are still mostly produced synthetically. BASF in Brazil is showing that this can be done differently. In the land of oranges (nowhere else do they grow more), the company extracts organic natural substances called terpenes from waste orange peels, which normally protect plants from bacteria and fungi. This makes them the ideal starting material for the preservative Lutensit® EcoCitrus, which extends the shelf life of household cleaners and detergents.

Photos: Ecovon, Evelin Fink, BASF SE, Kerecis, Natasa Kukulic/Stocksy



or

Timeless

trendy

?

Frank Giese TEXT

There are many reasons why certain pieces of furniture become design icons and are passed down from generation to generation. But what exactly distinguishes good design? And how does the growing demand for resource conservation and a circular economy influence these timeless classics, whose durability makes them inherently sustainable?

Photos: Wassily Lounge Chair by Marcel Breuer/courtesy of Knoll; Saariinen Round Dining Table by Eero Saarinen/courtesy of Knoll; Mart Stam/Recrollumen, Wishbone Chair by Hans J. Wegner for Carl Hansen & Son, PH-5 von Poul Henningsen/courtesy of Louis Poulsen



H

Having a piece of furniture described as “timeless” is an accolade many designers dream of receiving. But creating an object that will inspire people in the distant future is no easy task. It is certainly possible, as shown by the design classics that have already achieved this: Ludwig Mies van der Rohe’s elegant “Barcelona Chair,” for example, which doesn’t look like it will soon be 100 years old. Or the “Lounge Chair” by Charles and Ray Eames, the American designer couple who gave the prototype of this chair to their friend Billy Wilder in 1956, so that the director could comfortably take a break from the Hollywood bustle. Or the sculptural “Egg Chair,” with which Danish designer Arne Jacobson catapulted the traditional wing chair into the space age in 1958. Even people who know little about furniture design can recognize these classics by their silhouettes. These chairs are all still in production today, defying trends and fashions. Not only that, their owners often pass such objects down to future generations. But what defines a design as a classic? Does that mean it can’t be changed at all? Or can it also be impacted by the new demand for sustainability and a circular economy? And conversely, what does it mean for designers and manufacturers that for it to be long-lasting, the sustainable furniture they create today must also be timeless – perhaps to become a classic itself one day?



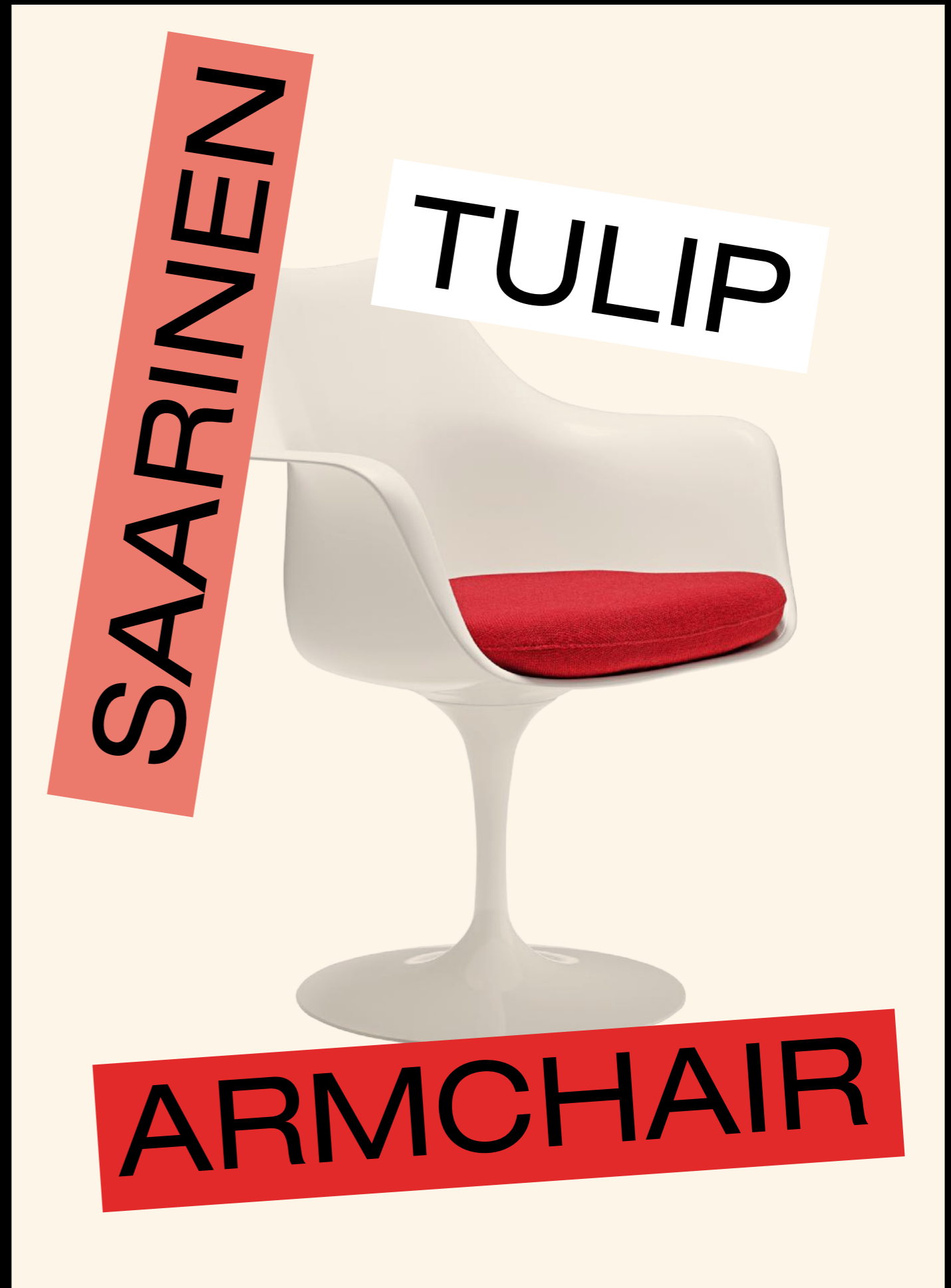
One person who accomplished this was the cabinet-maker Michael Thonet. When he and his sons began bending beech wood with steam in 1850s Vienna to craft a lightweight, stable, and even affordable café chair, it never crossed anyone’s mind that what the Thonets had created would become the archetype of all furniture classics. But their chair “No. 14” met all the criteria by which we still measure good design: aesthetics that immediately please the eye; a design that attests to high functionality and impresses by dispensing with any ornamentation – less is more! And finally: high-quality materials and a perfectly hand-crafted finish. Of course, designers have only limited influence over whether future generations will embrace an object and elevate it to classic status. As German celebrity designer Konstantin Grcic has noted, a designer can only aspire to “design things that have quality, that function but also have a beauty that leads to a relationship with the object. This creates the feeling that you want to live with things for a long time, take care of them and maybe even repair them. These are all tasks that we have to fulfill.”

Designed to last

Beauty, durability, functionality – these qualities also distinguish the furniture icons from the heyday of Classic Modernism after World War I. For example, the elegant chrome and glass table “E1027,” created by Irish designer Eileen Gray in 1927. Or Le Corbusier’s fur-covered chaise longue “LC4” from 1928. Other examples include pieces designed by Mart Stam, Marcel Breuer and Wilhelm Wagenfeld for mass production in the reformist Bauhaus spirit of the 1920s. But the steel tube chairs, innovative lamps and storage systems created by these and other designers for small apartments were ultimately produced only in small quantities – and even then, they were too expensive for many people to buy. Mass production only became a reality with the emergence of furniture discount stores in the 1960s. As a consequence, neither the manufacturers nor the buyers placed much value on the quality or durability of furniture that seemed inexpensive but was ultimately just cheap. That is why there are few classics in this segment. Something that doesn’t last long can’t become a design icon. A bizarre exception, of which there are a few: the “Throw-Away” sofa from 1965, which already carried the intended disposability in its name. The block seat consisted of foam with a vinyl cover and was promoted as a consumable item, as there was still limited awareness about wasting resources at that time. In a twist of design history, this sofa – as a brand-new luxury model with textile or leather upholstery that is actually replaceable, and as a vintage collector’s item (since some originals have apparently survived) – is selling for thousands of euros or dollars today.

And now? To become a hit, furniture needs to excel in more than just aesthetics, functionality and material quality. “Sustainability and the circular economy have become a given,” says someone who should know: Christian Grosen, Chief Design Officer of the

Photos: Adjustable Table E1027 by Eileen Gray/classicon.com, Tulip Armchair by Eero Saarinen/courtesy of Koolhaas/Hollman & Kravitz





Swiss company Vitra, one of the most distinctive designer furniture producers in the world. “Business and retail customers are increasingly interested in what they are buying – for example, a product’s contents or the story behind it. More often now, they also want a narrative, a statement, and not just a piece of furniture. So, it’s just a question of time until every individual and every company is forced to act sustainably and within the circular economy, because this is what customers expect.”

Enlightening insights

The changing demands, placed not only on the product but also on the conditions under which it was created, also present new challenges for designers. Transparency is key – as in the case of “Ayno,” a minimalist luminaire, which German designer Stefan Diez conceived a few years ago for the long-established manufacturer Midgard. The luminaire is made of mostly recycled materials, requires no tools for installation or removal by its owner, won’t pose any problems during electrical repairs, and can be disassembled into pre-sorted components for recycling after use. The manufacturer also states that the materials are sourced locally so that transportation and logistics leave only a small footprint.

The designer Nathan Yong from Singapore, who is known for sculptural chairs and sofas that appear to float in space, also sees the desire for transparency as a driving force. For his “Lifecycles” collection – a series of seating furniture and tables made of cherry, maple and oak – he performed a lifecycle analysis of

each design’s environmental footprint so as to draw buyers’ attention to the object’s sustainability. “When people consume something, they don’t always appreciate the true value of the object,” says the multiple award-winning designer about his approach. “I want these artistic works to enable them to question the true value of the objects for themselves, for nature, the community and the well-being of the planet.”

Imperfect perfection

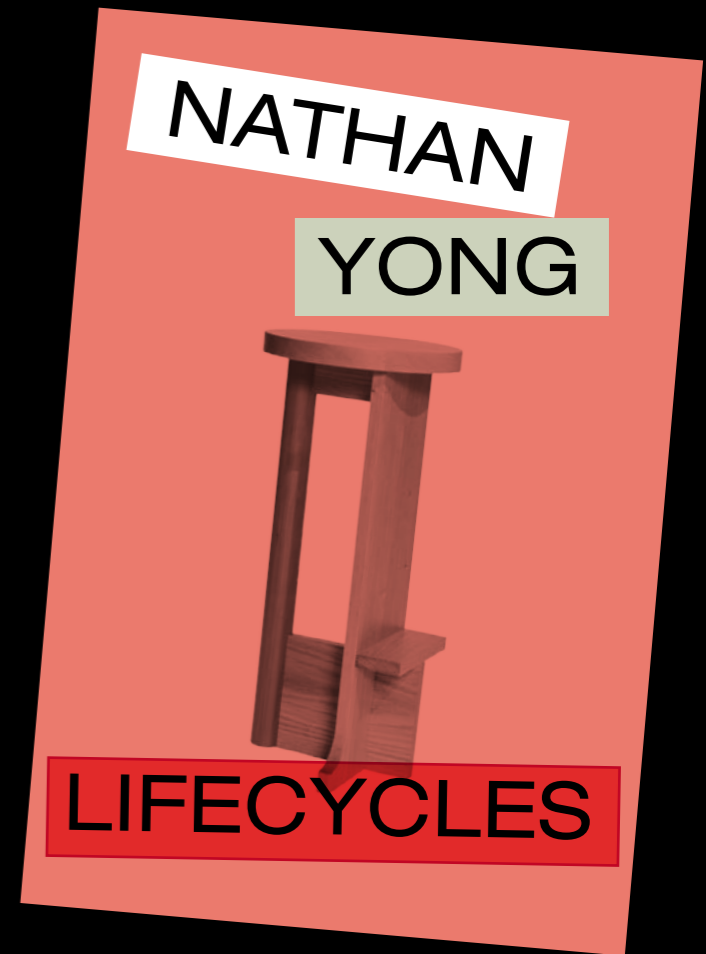
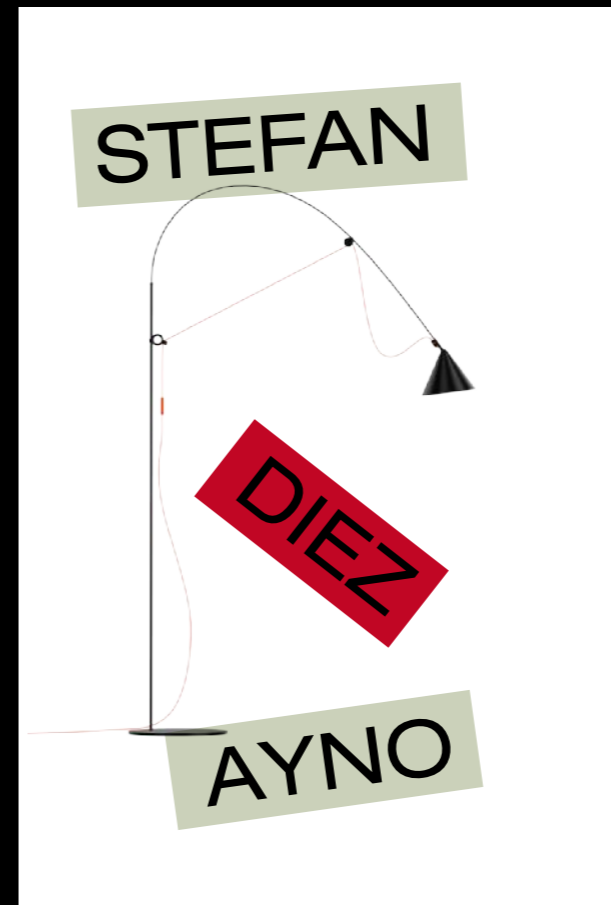
These days, Vitra is even working with recycled materials, although Chief Design Officer Grosen notes that it takes time “to develop good aesthetics with sustainable materials.” For example, when the company started to manufacture variants of the “Eames Plastic Chair” – another 1950s design by Charles and Ray Eames – using remanufactured polypropylene, there was a problem: “The seat shells have tiny pigment marks throughout due to the recycled material,” so the appearance of the classic chair has changed. How do customers respond? They don’t care, says Grosen: “Nowadays, they accept the material’s natural characteristics.” In any case, even with classic designs – of which Vitra’s portfolio contains an impressive number – Grosen believes that “they are never completely finished but are constantly evolving. Some of our products have been on the market for more than seven decades and have undergone numerous updates and improvements.” Another example of how classics move with the times: The dimensions of the “Eames Lounge Chair” described above have grown by several centimeters because people are bigger today than in the 1950s. By 1988, the typical Rio palisander for the plywood shells had already been replaced with Santos palisander, which is not an endangered wood species. And the soft polyurethane foam in the upholstery, which is made by BASF, is the first mechanically recyclable PU foam to be used in a Vitra product.

We’ve now come full circle. Even big-name designers will likely not argue with the need to continue updating their designs in keeping with the spirit of the times. Charles Eames saw the role of a designer as that of a “very good, thoughtful host, anticipating the needs of his guests.” He and his wife Ray obviously hit the nail on the head. ■

“Design classics are never completely finished but are constantly evolving.”

Christian Grosen, Chief Design Officer at Vitra

Photos: Thonet Nr. 14 by Michael Thonet/Thonet GmbH, Lounge Chair by Charles & Ray Eames/Vitra, Ayno by Stefan Diez/Midgard, Lifecycles by Nathan Yong



Stain busters

The secret to clean laundry: biotechnology assistants that remove dirt and detergent residue and save energy while washing.

As is so often the case with detergents, it's the mixture that matters. Or rather the "formulation," as the experts call it. Modern liquid detergents are based on a sophisticated formula of chemical compounds such as water softeners and surfactants, i.e. soap-like substances that can combine immiscible substances such as water and oil. When tackling particularly stubborn dirt, nothing works without the biocatalytic assistants known as enzymes. These are proteins that can accelerate chemical reactions. Their job is to support the metabolism of living organisms by breaking down proteins, fats and carbohydrates. It is precisely this ability that qualifies them as stain removers, with each enzyme having a specific role: Proteases successfully target impurities containing proteins, such as egg, milk and blood. Mannanases, on the other hand, target stains from guar gum and locust bean gum, which are often used as thickeners and stabilizers in processed foods. The enzymes break down the dirt in order to make the job of the detergent's surfactants easier, which ultimately involves dissolving the stains. As well as being highly effective, enzymes are also particularly eco-friendly. Modern enzymes, such as those developed by BASF for its Laverge® product line, are highly concentrated and effective in the smallest doses. They also clean at washing temperatures as low as 20 degrees Celsius – ordinary detergents without enzymes require 40 degrees – which saves energy and reduces carbon emissions.

But the effectiveness of the enzymes is not limited to stubborn stains. When combined with other ingredients such as polymers, i.e. substances consisting of specifically designed macromolecules, enzyme-based detergent formulations also counteract graying. This is true for both cotton and synthetic fibers, white or colored laundry.

Photo: The Vooches/Gallery Stock

Connecting for change

Motivated, dedicated and creative: Around 110,000 employees worldwide contribute to the BASF Group's success. When it comes to sustainability, everyone pulls together.

Let's take the chemist Dr. Jingwen Wang, for example: She grew up in a little town in northeastern China and has seen first-hand how climate change has altered the landscape and affected the quality of crops – for example through long dry periods. She wanted to make a difference, and her unwavering scientific curiosity led her to BASF in Shanghai where she and her team develop water-based car paints with a low environmental impact. As an innovation scout, Jingwen promotes the exchange between BASF and academia and collaborates with young talents from universities and startups to affect positive change in the automotive coating industry.



Photo: BASF SE

Discover Jingwen's story:
[basf.com/changemakers](https://www.basf.com/changemakers)

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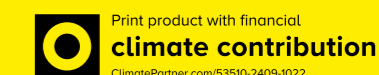
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