

“Aren’t you
scared to go?”

“No, no, not
any more now”

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Who should light the path to death?

Whether it brings you sadness or relief, shock or closure, as the loved one of a recently deceased person, you face an array of possible emotional paths. For society at large, the reaction can range from the whole topic being a taboo, whereby the corpse is deftly removed from sight, to what is a growing acceptance of this final farewell being a personalisable event. Indeed, the modern world's foray into individualism has opened the flood gates of yet another social pressure: 'getting your death right'. According to Daniel Di Falco (p. 12), much like we're compelled to ace our careers, strike a work-life balance and pull off childbirth without any hitches, we now have also to live in the looming shadow of the ultimate failure: missing the last train.

Death is absolute. It's fatal. There's no coming back. But take a closer look and this unambiguity vanishes. Biologists actually struggle to define 'decease'. It turns out to be a process that takes weeks to run its course (p. 15). And there are corollaries to this, particularly when it comes to organ transplant.

In the case of death, not even science can give clear-cut answers. In fact, with every new study there's a chance new issues will surface, be they medical, societal, legal or philosophical. And, as we rummage through them, we each apply our confirmation biases, because there's nothing universal about death. The way we all deal with it is deeply rooted within our religions, cultures and social groups, as well as our individual selves.

The developed world will be increasingly called upon to manage the end of individual lives. Medicine equivocates, aiming both to heal the patient and to offer him or her autonomy. It offers the choice of deciding for oneself when to turn down treatment, to flick the final switch and to accept the inevitable (p. 21). This most intimate of choices may overwhelm us, and so society must hold our hands as we tackle this difficult terrain. Although it's an individual decision calling for self-determination, we don't necessarily have to make it alone.

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horizons





Valérie Chételat

2. stock süd



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◀ Cover: These are the reminiscences of a 65-year-old ALS patient about the death of her mother, who had dementia. They are taken from an interview carried out as part of the project described on page 11.

◀ Inside cover: What remains? The room is empty. The body is falling apart. What remains are memories.

Photo: Valérie Chételat

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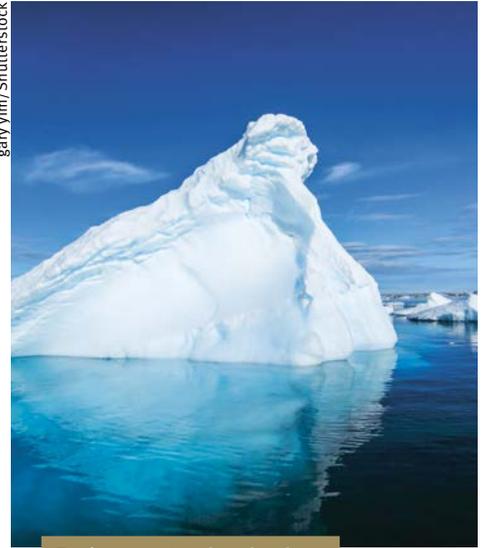
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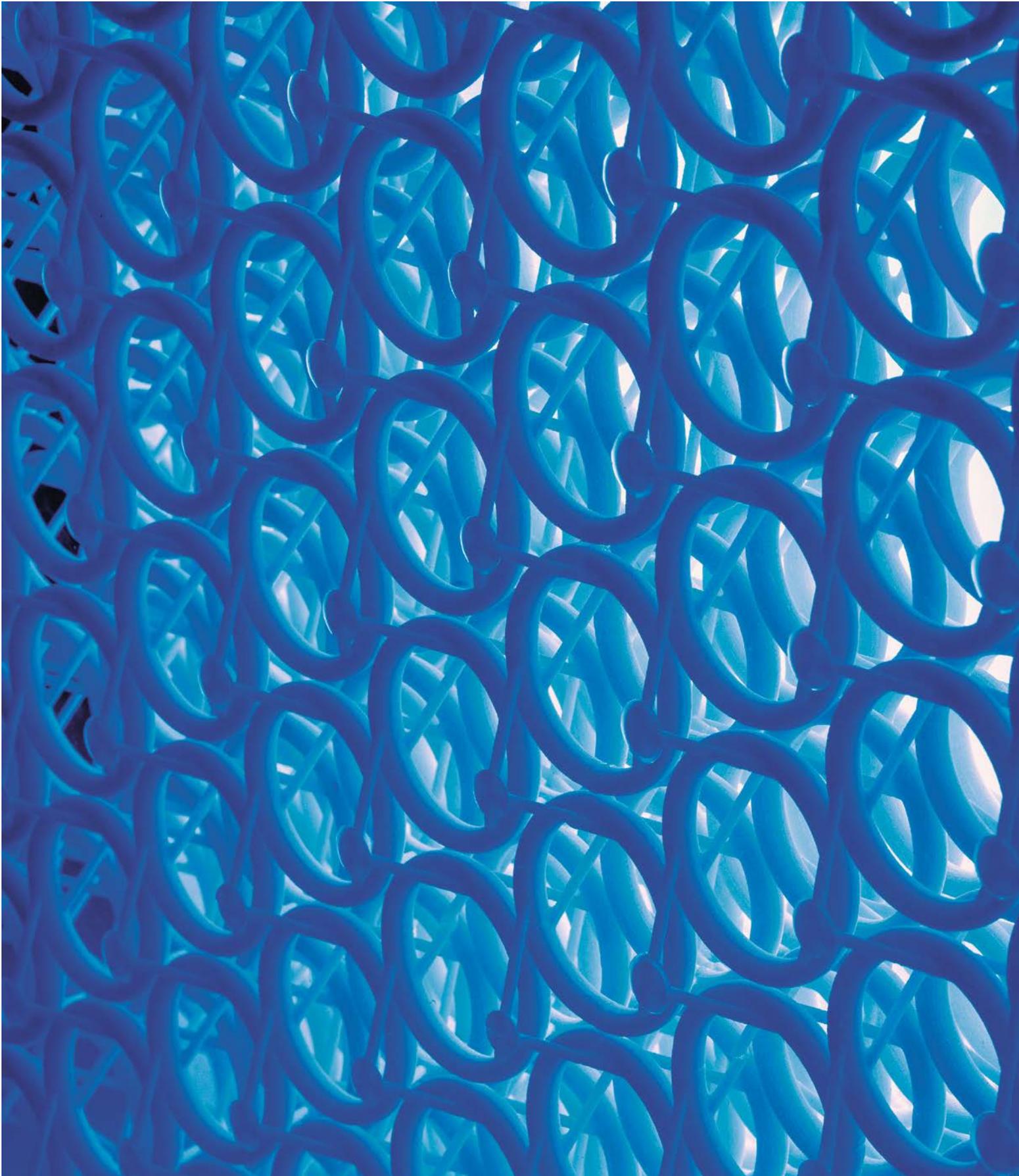
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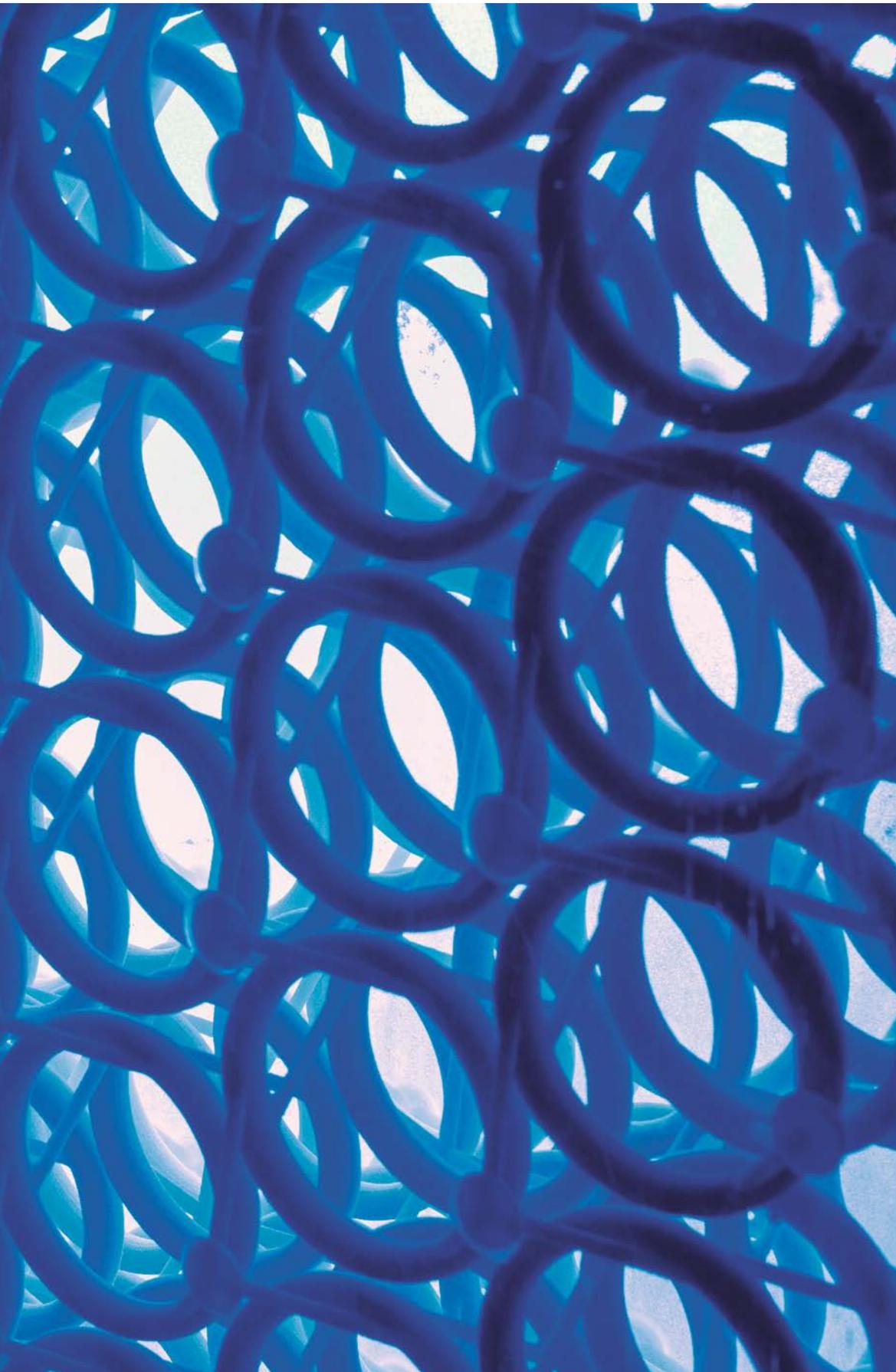
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The springs of silence

This eerie arrangement of tiny, spring-like structures has one goal: noise reduction. It's 50 cm square in size, and might one day be used in buildings, cars and planes, says its creator, Andrea Bergamini from Empa in Dübendorf. It's a remarkable example of phononic crystals: structures arranged with a precise periodicity so as to absorb or deflect sound waves. "It's a pretty recent field of research", says Bergamini. "Its name refers to phonons, which are vibrations propagating in solids, and was inspired by its older brothers, the photonic crystals that are able to block or redirect light".

The structure is manufactured with a 3D-printing technique called selective laser sintering (SLS), where polymer powder is deposited layer by layer and melted by a laser to consolidate it. "We've created spring-like shapes in order to change the way the overall structure reacts to incoming sound waves: the 4 cm-wide rings cannot only move left, right, forwards and backwards like tiny balls of matter, but can also twist around their axis of symmetry". This additional movement enabled the researcher to explore more configurations before manufacturing it. "Our goal was to create a material that is reasonably small, and stiff so that it can bear loads, but also light enough for automotive or aerospace applications. It's a difficult combination, but we've succeeded. Our device attenuates 99 percent of 800 Hz waves, which is the typical frequency range of vowels in human speech".

The Empa team will insert their structure into a sandwich of polymers to test it as room panels. As the arrangement is largely empty, it lets most light through. While too thick (10 cm) to serve as a window, it could be used in sound-proofing panes separating rooms without blocking out daylight. *dsa*

Image: EMPA/Fotograf Beat Geyer

Should we declare the Anthropocene?

The human species has a major impact on the planet. This is why the International Union of Geological Sciences has proposed introducing a new epoch, the Anthropocene. Is this a good idea?

Manu Friederich (photomontage)



Yes

says Flavio Anselmetti
of the University of Bern.

The Holocene epoch began at the end of the last Ice Age: 11,700 years ago. The world population grew quickly after that, and in recent decades it has begun to alter the Earth's system so drastically in such a brief geological time, that we shall probably soon reach the limits of what the human species needs to exist.

This is why it makes sense to announce a new epoch, the Anthropocene. As with many other geochronological units, this epoch is being initiated by a mass extinction, and it has already begun through human intervention. Nuclear experiments have released radionuclides that did not exist in the preceding 4.6 billion years in the history of the Earth. The use of fossil fuels that are millions of years old is releasing a huge quantity of greenhouse gases. This in itself is not unique in the history of the Earth, but the speed of change and the fact that a single species has triggered it knows no precedent. In certain areas, soil erosion caused by agriculture has brought about deposits of thick clay layers that are clearly different from 'natural' sediments. The 'Maya clay' in the Central American rainforest is impressive testimony to the impact of high civilisation.

In order for all scientists to be speaking the same language, the International Commission on Stratigraphy must also define this epoch precisely. Recent geological deposits offer different possible dates for the commencement of the Anthropocene, but this is not surprising given the different sediment-forming processes involved. What characteristic, human-induced layer the Commission ultimately chooses, and what date it determines for its starting point, is thus of secondary importance.

“Man will serve future species as an index fossil”

Flavio Anselmetti

The stratigraphic marking of the start of the Anthropocene is not just symbolically significant. The epoch will signify a new state of things on the Earth's system and also explain major trends in the chronology of numerous benchmarks. The striking shifts in geological deposits show clearly that we are not dealing with a short-lived phenomenon. The Anthropocene will not

have to hide behind the Holocene in terms of its duration. Humans will have played a key role in the Anthropocene, and will serve future species as an index fossil in stratigraphic classification.

Flavio Anselmetti is a professor of quaternary geology and paleoclimatology at the University of Bern and was previously Head of Sedimentology at the Swiss water research institute, Eawag, in Dübendorf.



No says Jed O. Kaplan
of the University of
Lausanne.

While ‘anthropocene’ is a valid political concept, it requires no formal definition or stratigraphic ‘golden spike’. As the lower-case ‘anthropocene’, it acknowledges the contemporary observation that human activities are now as important as variations in the Earth’s orbit around the sun, or plate tectonics as an ultimate driver of Earth’s system processes. It is important to recognise that humanity’s actions have consequences for the planet that are truly global in extent and may be leading to changes in ecosystems, landscapes and climate that are effectively irreversible on geologic timescales. On the other hand, a capitalised ‘Anthropocene’ epoch as part of the geologic time scale is not only problematic to define without any hindsight, it is wholly unnecessary.

The geologic time scale was a triumph of 19th-century science, but it has largely been supplanted in scientific and educational value by absolute radiometric dating. Lacking any method for absolutely dating events in earth history, early geologists presumed that rock layers containing similar fossils must have been laid down at about the same time, and the first geologic time scale containing the divisions

of time still used today was developed by 1850. Transitions between geologic epochs were defined by the first appearance of certain fossils that could be observed in strata at a number of localities. The boundary between one geologic epoch and another is marked at a specific locality with a ‘golden spike’, literally a plaque or other marker identifying the transition in the rock layers. Much of the recent discussion and debate around defining an Anthropocene has therefore centred around where to place the ‘golden spike’ defining the beginning of our epoch.

“The geologic time scale has largely been supplanted by absolute radiometric dating”

Jed O. Kaplan

However, most modern scientific and even lay literature does not refer to stratigraphic epochs when defining events, except in an introductory sentence. Few people beyond geology undergraduates have memorised the order and variable length

of the epochs of the geologic time scale, but it is immediately obvious to any reader that the extinction of the dinosaurs about 65 million years ago happened long before the evolution of modern humans, about 200,000 years before the present.

Beyond being fraught with problems of perspective: how can we define an epoch in which we are currently living and without an obvious endpoint? The concept of the Anthropocene epoch is completely unnecessary in modern science. Even without it we can precisely date the successive influences of humans on the Earth’s system, from our evolutionary beginnings to the present.

Jed O. Kaplan is a professor at the Institute of Earth Surface Dynamics of the University of Lausanne. He studies environmental history and the interactions between humans, land cover and climate.

I would like to fall
asleep and emerge on
the other side.
For there isn't any
wall between us,
is there?!

84-year-old patient with gallbladder cancer, two days before his death

The last farewell

It's inescapable and as unique as the life it takes: Death. Our finiteness also fascinates scientists and scholars. While biologists and medics discuss the point of death, lawyers and sociologists are busy with issues of self-determination.

The quotes in this section are from patients with advanced, incurable diseases. Taken from interviews carried out by Heike Gudat and her team, they offer insights into fear and desire in the face of death. Gudat is a palliative care doctor and is heading the project 'The wish to die in

persons with serious illness'. The interviewees were 62 patients and their next of kin and medical staff. This qualitative study is part of National Research Programme 67 'End of life'. The conclusion: we should beware of expecting people to accept their death.

Project death

Death used to be a taboo of modern times. Today it's a very public, permanent guest and a pending topic in our personal life plans.

By *Daniel Di Falco*

Everyone has to die. But whether we're able to do it properly seems to be another matter altogether. 'Dying and learning to die', 'The ability to die' - so common today are book titles like these, they could easily fill half a bookshop. Then there is: 'Dying for beginners', 'Training manual for accepting the inevitable', and 'Travel guide for your last journey'.

Such how-to books tell you about making a living will and about liquidating your home and possessions - things we're told we should organise in advance, as it's 'better late than never'. They even offer 'checklists for saying goodbye'. But they also explain dying itself - 'what we can do to achieve a good death', and 'how we can overcome our fear of dying'. Apparently, 'fear' is a blockage that 'prevents us from letting go'. We might all want to live a life that's 'organised, well thought-through and doubly insured', but are we 'equally well-prepared for our transience'?

It's obvious: death is very much on the agenda. It has now become an object of life-style planning. The Augsburg sociologist Werner Schneider has diagnosed a "fundamental transformation" in how society deals with death. The transition to the 21st century, he says, brought about "an increasingly discursive process" about death. It's now a growing topic of public discussion.

An unforeseen comeback

This is unexpected. Until recently, one of the characteristics of Western modernity has been its avoidance of the topic of death. In the course of the 20th century, death was 'expatriated', writes the French historian Philippe Ariès in his 'History of death'. Death was more and more often relocated from the home to the hospital, and left to

the doctors. It did not just lose its ecclesiastical context, but also its public value. It became an invisible, even 'secret' event.

The ethnologist and sociologist Bernard Crettaz from the canton of Valais has spent half his career researching into death. When he looks back today, he believes that a "marginalisation" of dying took place, primarily in the years after the end of the Second World War in the era of the consumer society and the post-War economic miracle. It was especially the dead body that disappeared from view, writes Crettaz: "It was disposed of as quickly as possible".

After having been sent into exile, death is returning to our everyday lives

However, already in the late 20th century, Ariès noticed that something might be changing in our relationship with dying - such as among the psychologists who were criticising the suppression of public mourning. Today, what he presaged has become a certainty: "The changes are dramatic", writes the sociologist Hubert Knoblauch from Berlin, who has detected an "increasing popularity of death". Knoblauch believes that this development began in the social movements that made dying into an increasingly public topic from the late 1960s onwards: from the 'death awareness' and 'natural death' movements via the Aids phenomenon to palliative care and the hospice movement.

Today, the 'presence of death' is evident not just in the frequent debates about assisted dying, palliative medicine or brain

death, but in the midst of our daily culture. There is an expansion of the ways we commemorate the dead, a new diversity of burial forms, a growing body of 'self-help' literature, and even a foray into the TV series we watch of an evening - from 'Six Feet Under' and 'Bones' in America to the Swiss-German series 'Der Bestatter' ('The Undertaker').

Entertaining death

The era of repressing death and dying seems to be over. And Knoblauch isn't the only researcher to have reached this conclusion. The cultural philosopher Thomas Macho speaks of a 'new visibility of death', while the sociologist Klaus Feldmann writes of its 'return': dying might have been exiled from the everyday lives of most people, he says, but it's coming back to visit them via the media.

One example is the death of the English dental assistant Jade Goody. First she converted her life into reality TV as an inhabitant of the 'Big Brother' house, and then she did something similar with her death. She was 27 years old when she was diagnosed with cervical cancer - and millions watched live as she got her diagnosis. Afterwards, she let everyone watch how her hair fell out and how she became weaker and weaker. Whether on TV or on the title pages of the newspapers, everyone saw 'the oxygen mask over her agonised face' (in the words of the German newspaper 'Die Zeit'), the kisses from her husband, her fear of the end, her tears, her worries about her two sons and her pleading for the 'death pill'. She even sold her dying breaths to the pay-TV station 'Living TV' - but ultimately, Jane Goody died in private after all, in the early hours of 22 September 2009.

Failure is possible everywhere, even on our deathbed

Conversely, dying can today make complete unknowns into public figures – such as Norma Bauerschmidt from the USA. She was diagnosed with cancer at the age of 90. But she refused to start any treatment, instead going on the ‘journey of her life’ (in the words of ‘Spiegel’ magazine) across the whole of the USA, accompanied in her mobile home by her son and daughter-in-law. Facebook let the world follow her by reading her everyday diary as she was dying – under posts entitled ‘Driving Miss Norma’ – and the longer she was on her travels, the better known she became through the press and TV. Her life came to an end one year, 15,000 miles and 450,000 Facebook ‘fans’ later. When her condition made it impossible for her to continue travelling, she moved into a hospice for the dying on the Pacific Coast, where she passed away in autumn 2016.

Individualised farewells

Jade Goody and Norma Bauerschmidt were media phenomena for a media audience. This is also true of the online, live-stream funerals that undertaking companies are now offering mourners in the USA.

This new visibility of death is even more far-reaching, however. Bernard Crettaz has observed how the family and next of kin of the dying have begun taking on tasks previously assigned to experts in the medical, therapeutic and social fields: “To a certain extent, death is being retrieved from the technocratic sphere and is moving more into people’s everyday lives”. One example is the funeral supper, which has been regaining importance in recent years as an event where relatives, friends and acquaintances become a community, offering comfort amidst the mourning. As Crettaz points out, death is also “an exceptional moment of social bonding”.

Undertakers are also acknowledging this fact. They have noticed that there is an increasing desire among the bereaved to take on tasks themselves – such as the design of the coffin and the urn, the speeches at the funeral or even the administrative formalities. Nor is this merely for reasons of economy, as it also signifies a return of personal engagement. “The next of kin want to become active again. Today, they’re making more and more requests concerning the actual funeral”, says Crettaz. “Many undertakers today allow them to partici-

pate in rituals, even with regard to the body of the deceased. The next of kin are being allowed to wash them, comb their hair and dress them”. This is surprising, as in modern times we have traditionally focussed our fear of contact on the corpse itself. “But there has been a reawakening of awareness that the body is an important part of the whole theatre of death”.

Live and let die

So, after having been sent into exile, death is returning once again to our everyday lives. We used to be happy to delegate things to functionaries. But today, the notion of self-determination has even reached the dying process. Our epochal urge to individualisation is now getting to grips with dying. But the consequences are just as ambivalent as they are with any other such trend in our times. As always, self-determination also means self-commitment. And this applies just as much to those who are dying.

“Death is an exceptional moment of social bonding”

Bernard Crettaz

Werner Schneider has been investigating the current debates about living wills and organ donations. He sees a “new normal” in how death is dealt with, according to which “we are now supposed to plan, organise and manage our own dying”. Death has become a project in life. The current ‘guidebooks’ also advocate for this, measuring up the various options for dying from ‘success’ to ‘failure’. “When will I die, and how? How can I make things easier for my next of kin? What do I do with the ‘treasures’ I’ve acquired in life? Will people be allowed to laugh?” These are all questions that must be answered, according to a recent book by a psychotherapist and chairman of a hospice association. Whoever wants to achieve “a relaxed, anxiety-free approach to dying” today needs “a clear concept and a conscious attitude” towards death.

Schneider sees here a new kind of “compulsion to attain a socially acceptable degree of concern for the last things”. He believes that society is “monopolising” and “remoralising” the process of dying. And he

also feels that we must question these new norms. “Does everyone really have to want to decide whether brain death is ‘dead enough’ for us to be assigned for organ donation? Does everyone have to want to prevent their relatives from making decisions? Does everyone have to want to spare doctors and society from any unpleasantness? Who could here claim to be a truly autonomous subject if he isn’t allowed to change his mind about things – including the ‘last things’?”

Fate is out of fashion

When it comes to the crunch, these questions become ever more pressing. “Death used to be a byword for a fate beyond one’s control”, writes Heinz Rügger, an ethicist and theologian from Zurich. Today, thanks to our longer life-expectancy and the possibilities of modern medicine, death has instead become a matter of decision-making processes (see page 21).

According to Rügger, it’s part and parcel of the “dignity of every human being” to be able to organise both our life and our life’s end according to our own wishes. But at the same time, Rügger shares Schneider’s concerns. We might want to experience the swiftest possible, pain-free death, in a state of mental clarity and in full control of our physical and social responsibilities, independent of the care of others. But, Rügger believes, this runs the risk of our becoming beholden to ‘societal pressure’ that turns the question of a ‘dignified’ death into an act of individual, personal responsibility, something that we owe to our relatives and to society in general. The current idealisation of self-determination on our deathbed thus has a downside. “It means that what was intended as an act of liberation instead becomes a new compulsion – one that can demand too much of individuals and in fact denies them their dignity when they don’t succeed in achieving a ‘good’ death”. In other words: our progressive society is on the verge of expanding how we evaluate our sense of fulfilment in life. And this opens up to us the possibility of ‘failure’, right to the very end.

Daniel Di Falco is a historian and a journalist for the ‘Bund’ in Bern.

I've been waiting so long now for death. I would just like to sleep my way over.

She knows it, but it's dreadful to her. If she didn't love me so much, I wouldn't have done any chemo.

77-year-old patient with lung cancer, 11 days before his death

Pinning down demise

The precise moment of death cannot be determined unambiguously. But society needs a clear criterion for decease – not least because of issues such as organ donation. *By Yvonne Vahlensieck*

Regardless of whether we die early by accident, or whether we reach a biblical age before our demise: at some point, our heart will stop for good. At some point, we shall also stop breathing. And at some point, our brain will also cease to function.

“It can take up to a week until the final cell in the body has died off”, explains Stephan Marsch, Head of the Intensive Care Unit at the University Hospital of Basel. But when asked for the precise moment when the transition from life to death occurs, not even he can give a definitive answer. “In biological terms, death is a process”. For example, the cornea can still be transplanted successfully three days after death. And up to a week after death it is still possible to remove and cultivate specific types of cell from the body, such as cartilage.

Irreversibility is key

But there are legal and societal demands to establish a more precise boundary. “We can’t say that someone is a little bit dead, or that they’re still a little bit alive”, says Marsch. But the binary ‘yes or no’ cannot be so easily reconciled with a biological process. That is why experts make use of the criterion of empirical irreversibility. “If, in line with accumulated experience, a person cannot come back to life, or cannot be reanimated, then he or she is regarded as dead”.

Opinions about when this point is reached have changed several times over the course of medical history. Until the 19th century, people depended on their own observations. In cases of doubt they waited several hours until rigor mortis had set in. Only after the invention of the stethoscope did the medical profession recognise

the connection between the beating heart and life itself. Though they weren’t quite certain about that, either. Medical historians tell of sometimes brutal methods with which a doctor might determine that their patient was truly dead – such as sticking needles under their toenails, or dripping hot wax onto their forehead. But better stethoscopes soon enabled them to realise that cardiac arrest was a reliable way of knowing that someone had indeed died.

From cardiac arrest to brain death

With the rapid development of intensive medicine in the 1960s, however, began the questioning of the validity of cardiac death. The advent of artificial respiration meant people could now be kept alive, when the failure of spontaneous breathing would otherwise have led swiftly to cardiac arrest. But in some of these patients, the brain had completely ceased to function. So were they now alive or dead? At about the same time, transplant medicine was celebrating its initial successes – and it was precisely these people on artificial respiration who were particularly suited to organ donation, because their heart, kidneys and lungs were still fully functioning. So pressure grew to find a new, reliable criterion for death in such cases. In 1968, a committee at Harvard Medical School first suggested using brain death.

Brain death is defined in Switzerland as the irreversible failure of brain function, including that of the brain stem. The brain stem is regarded as the most resilient part of the brain and is the seat of the respiratory centre. If the brain stem stops working, then breathing stops, and the heart gets no more oxygen. Without artificial respiration, cardiac arrest is inevita-

ble. Conversely, cardiac arrest also brings about brain death in the shortest space of time. Because if the brain is not provided with oxygen through the circulation of the blood, then brain activity ceases after about ten minutes.

The same death for all

In Switzerland, it was the implementation of the Transplantation Act in 2007 that first brought about the recognition of brain death as the unique criterion for death in all cases. The bill for the law referred to the guidelines of the Swiss Academy of Medical Sciences (SAMS). They, in turn, stipulate what clinical signs of brain death must be determined, and how to do so. These include the lack of specific reflexes, dilated pupils, and a respiratory stop after artificial respiration has been removed.

“In biological terms, death is a process”

Stephan Marsch

Jürg Steiger, the head of the Department of Transplantation Immunology and Nephrology at the University Hospital of Basel, regards the current definition and diagnosis of brain death as safe and reliable. As the chairman of the Central Ethics Committee of the SAMS and of its subcommittee for revising the guidelines, he has been involved with this topic for many years now. “The criteria have remained unchanged for twenty or thirty years. There is no evidence at all that we should change anything”. Nevertheless, he can well understand that the concept of brain death is difficult to grasp for many

people. A brain-dead person on artificial respiration looks like he is still breathing. And his body is warm.

Residual brain activity

However, doubts regarding the validity of brain death arise not just on account of external perceptions. Brain-dead people can also maintain many metabolic processes independently. They digest, regulate their hormonal balance, and fight infections. In some cases, brain-dead women have even given birth to healthy babies. Critics of the brain death approach also point out that, after brain stem activity ceases, residual activity can still be proven to occur in individual cells of the cerebral cortex. It is also disputed whether an organ donor might still be able to feel pain. The SAMS guidelines stipulate that anaesthesia is to be administered during the removal of organs, but this is a quite unrelated matter; the anaesthetic is intended to suppress reflexes that can still be transmitted through the intact spinal cord.

For Steiger, the brain remains the decisive organ – also as a result of his personal experiences with dying people and with the deceased. “The heart is just a pump that you can replace with a mechanical device if necessary. For me, life occurs in our head: pain, love and hate”. Even someone who has had a leg amputated can still feel pain in a toe. This is a clear sign that the pain is perceived in the brain, not in the rest of the body. “If the brain doesn’t function any longer, a central aspect of your personality also disappears”.

Personalised criteria for death?

Just where our personality actually resides, and whether it is extinguished at the point of brain death, was barely discussed in Switzerland when the law was introduced in 2007. Ethical discussions were focussed chiefly on aspects of consent for organ removal and the equitable distribu-

tion of the organs donated. Pascal Lachenmeier is a legal scholar whose doctoral thesis at the University of Basel undertook a closer analysis of determining the point of death as enshrined in the Transplantation Act. “Introducing the concept of brain death did not cause many waves in the general population. People don’t like to address the matter of their own death, and in this case they relied on the natural sciences to provide a safe method”. He regrets that the legislators treated the criterion of death as a purely technical matter, delegating it to an institution such as the SAMS instead of holding a broader social debate about death.

“When the brain stops,
a central aspect of our
personality disappears”

Jürg Steiger

The fact that the criterion of brain death has meanwhile become valid in almost all countries does not mean that it is incontrovertible. In the USA, for example, some have suggested using the loss of cognitive abilities as sufficient proof of death – in other words, the moment when the cerebrum ceases to function. Lachenmeier, however, suggests a fundamentally different concept, and questions whether a society can, or must, have any generally valid definition of death. In order to take into account all the different understandings of the point of death, all people should instead be allowed to define individually what for them constitutes the boundary between life and death – inasmuch as irreversibility is guaranteed, as in the case of brain death or cardiac arrest.

Yvonne Vahlensieck is a freelance science journalist who lives near Basel.

The moment of murder

When solving crimes, the time of death is an important piece of information. If the deed occurred only one or two days before, then forensic experts can narrow down the point of death precisely to within a few hours. To do this, they analyse the livor mortis, the degree of rigor mortis and the body temperature. They also stimulate the muscles in the eyes and mouth using minor electric shocks, and then observe how strongly they contract.

“But if death took place further back, we can only offer rough estimates as to how many weeks, months or years”, explains Silke Grabherr, the director of the University Center of Legal Medicine, Lausanne – Geneva. The most important indicator is the process of decomposition, which spreads from the intestinal flora through the blood vessels in the body. A further indication is gained from the condition of a wax-like substance that forms from body fat in so-called ‘wax corpses’ in the absence of air.

But Grabherr believes that analysing flies and maggots that settle in a corpse is usually unreliable: “You rarely know for sure whether these are really the first generation of the insects”. Other methods might be able to determine the time of death using the concentration of metabolic products in bodily fluids. But these are still in their development phase.

I was already halfway up there. And when I came back, someone was holding my hand.

I asked:

“Are you a priest?”

No, he said, he was a student.

Oh, then I began to cry. Do you know why? Because I'm still allowed to be here. He didn't want me yet.

58-year-old patient with Crohn's disease, Bekhterev's disease and chronic obstructive pulmonary disease, five months before his death

Death and the researcher

From philosophy to biology and materials research: far beyond the bounds of medicine, the human and natural sciences are engaging with the end of life.

By Roland Fischer (rf) and Luzia Budmiger (lb). Illustration: Christoph Frei



What we lose with death

For good reason, the death of loved ones makes us unhappy to the point of despair. But what about the prospect of our own death? It's not always irrational for it to make us feel regret, says the philosopher Federico Lauria of the University of Geneva. In his research project 'Death and powers' he has developed his own approach to this thesis. His inspiration comes from the interdisciplinary 'Immortality project' currently running at the University of California. Death robs us of the ability to enjoy the benefits of life, says Lauria. This is why we have good reason to approach it with a sense of sadness. Lauria's research aims at justifying our feeling of sadness when faced with the prospect of our own death. But it also offers us a perspective based on the other side of the argument: would it be irrational to wish ourselves immortal instead? *lb*



Rapid rot

Our interaction with dying does not end at death. Human pathologists try to prevent the decay of the body for as long as possible, but Francis Schwarze, a tree pathologist at the Swiss Federal Laboratories for Materials Science and Technology (EMPA), is using his expert knowledge to accelerate the process of decay. Early on in his research career he was employed to give expert opinions on the state of trees in cities, especially with regard to fungal diseases. For a good ten years now he has been putting his knowledge to good use in a start-up company that has created a quite special fungal mixture. When applied to coffins, they pass over considerably quicker into the heavenly forests (and take their corpses with them). *rf*



Learning from cell death

Our bodies dispose of billions of cells every day. In order for this process to function properly, the cells are inscribed with a kind of 'suicide program' that can be triggered by signals from either inside or out. This 'apoptosis' is found in both complex and simple organisms. The molecular, biological fundamentals are astonishingly similar in each case, says Michael Hengartner of the University of Zurich. In order to understand the process better in humans, his group is investigating apoptosis in the threadworm *C. elegans*. How exactly does a cell 'notice' that it is irrecoverably lost – perhaps because its DNA is damaged? And what signalling pathways lead to its death and elimination by its neighbouring cells? Medical researchers are also interested in the precise processes in these model organisms. They would like to boost apoptosis in cases of cancer, but inhibit it during a stroke. *rf*



Unequal to the grave

Today, most of us die in old age. This makes us all the same before death: fragile. At least, that's the common opinion. But this homogeneous image of death is being debunked by Marthe Nicolet, a sociologist at the Interfaculty Centre of Gerontology at the University of Geneva. Her work is benefitting from her current visit to the National Institute for Demographic Studies (INED) in Paris. Using obituary notices from Switzerland, she is investigating people's environment at the end of their life – their families, economic situations and medical care. The words of thanks penned by the next of kin are especially revealing: our last phase of life is marked by inequalities. Nicolet's doctoral thesis 'Annoncer la mort' ('announcing death') focuses our gaze not just on how we die, but on how we age. And she shows us the society in which we live today. *lb*



The urn supplants the coffin

Even dying does not stop the march of modernity. Thirty years ago, only few people were cremated in Taiwan, but today it is one of the countries with the highest proportion of cremations in the world. Not even ten percent of the deceased are buried there anymore. This shift has also been driven by the state authorities, whose reasons are founded in land-use planning and economics. Taiwan is simply following a global trend. But this cultural paradigm shift in funerary practices also displays regional variations, as the religious scholar Urs Weber has found in his extensive field research and conversations with authorities, funeral homes and those responsible for the ritual aspects of death. It's not just a result of secular upheaval, but also of religious changes. Buddhists prefer cremation, and since the 1980s they have quintupled their numbers as a proportion of the residential population. *rf*



Dead poets' dialogue

Reading is a kind of silent dialogue with the author. In libraries, we find the voices of authors from all periods of history, gathered in a single space. You could imagine them as a kind of society of dead poets and thinkers. Such ideas are found throughout the history of literature, as the classical philologist Rebecca Lämmle explains: time and again, writers conjure up underworlds in which long-dead authors speak again, talk to each other, or answer the questions of the living. Such dialogues between the great figures of different epochs offer Lämmle an alternative form of writing literary history. When the poets and thinkers of the past become alive again, they negotiate tradition and innovation in a dialogue across the ages. *rf*



The fingerprint of putrefaction

When a corpse decomposes in nature, a kind of microbial oasis is established in that spot and remains there for several years. A dead body means new life – that's a biological truism. But the actual variety of this new life was a surprise to the soil ecologist Edward Mitchell from the University of Neuchâtel: "In such spots, we find a highly characteristic population of microorganisms. These include very rare species, and even species we've never encountered before". And it's not just biologists who are interested in this 'fingerprint' left by a body in the soil. Forensic experts are also keen to know more. Analysing these microorganisms promises to complement the insect analysis that is already a standard practice in criminal cases. Mitchell's group is working on this, too. "It's just a matter of time before this method has become established in the courtroom", he says. *rf*



Dying? No thanks.

Freshwater polyps might be tiny and inconspicuous, but they bear a series of astonishing characteristics. Some researchers even believe that they are immortal. Brigitte Galliot of the University of Geneva is more circumspect in how she puts it. Under ideal circumstances, you see almost no ageing process in these rod-shaped little creatures. How they manage this has not yet been fully explained. Galliot's laboratory is investigating the role of their stem cells in particular, which can restore any part of the body at will. When placed under stress, these polyps shift from asexual to sexual reproduction, and thereby lose much of their stem cell magic. Does this fact perhaps conceal a basic principle of ageing? Galliot's group hopes that their work will help us to better understand our own ageing process. *rf*

Roland Fischer is a science journalist.
Luzia Budmiger is an editor at the Swiss Academies of Arts and Science.

I've had enough.
If only I could die! Just
now, another friend of
ours died in the ward.
Then I think: Yes, damn
it, it should rather have
been me! I imagine doing
something to myself. Or
jumping off somewhere.
But first you have to get
up there, it won't work
in a wheelchair. Yeah.
You can really laugh if
you want.

67-year-old man with life-long multiple sclerosis, four months before his death

The most personal decision of all

The sophistication of today's medicine means that when and how we die is no longer left to fate alone. It is also a consequence of our own decisions - but we rarely take them consciously. *By Susanne Wenger*

It took thirteen days for Terri Schiavo to die after the doctors took out her feeding tube. For fifteen years, this 41-year-old woman from Florida had lain in a vegetative state after cardiac arrest and brain damage. Her death in late March 2005 was preceded by a bitter dispute. Her husband wanted to let her die, but her parents fought for her to be kept alive. Both sides claimed they were acting in her best interests. The Schiavo case went through the US courts, was debated by politicians, and attained considerable worldwide attention. It is regarded today as a tragic example of the complexity that such situations can take on - especially when the person actually affected cannot express an opinion.

However much we profit from the successes of modern medicine, many people refuse the option of being kept alive, because they don't want "to be hooked up to tubes or machines". No one can know in advance how it feels to be in a coma or to have dementia. But people wouldn't like to be kept alive at any price.

It is common in Switzerland for end-of-life medical decisions to be made that might possibly (or even probably) accelerate the inevitable. And such decisions are becoming increasingly common, as has been shown in a study conducted by the universities of Zurich and Geneva. In cases registered in German-speaking Switzerland in 2013 where death was not unexpected, 80 percent of the deceased had taken advance decisions about the end of their lives. In the great majority of cases, treatment was either discontinued, was not begun at all, or more drugs were

administered to alleviate pain and other symptoms. In a small number of cases, the people concerned died by means of assisted suicide. This representative data comes from a survey of doctors.

Let's put an end to paternalism

But it's we ourselves who decide about the last things. Patient autonomy has become a core legal and medical/ethical principle in recent decades. It has equivalence with a doctor's duty of care. Our previously paternalistic relationship with medical professionals - along the lines of 'doctor knows best' - has purportedly given way to an interaction between equals. After the doctor has given his or her findings, the patient agrees to a particular treatment - or not. Informed consent is what the experts call it.

"What's important is to keep checking with the patient. Because people change"

Tanja Krones

The Swiss Act on the Protection of Adults, which entered into force in 2013, strengthens the law on the right to self-determination. For the first-ever time, the patient decree, or 'living will', was established on a national basis. This allows a person to determine what medical measures they wish to accept or reject when they are no longer able to express themselves. It is binding for the doctor. Even if no such patient decree exists, the doctor may not simply take a

decision on his own. He has to consult the next of kin too. But not even their views are binding - it's the presumed wishes of the patient that are paramount.

Studies carried out by the universities of Lucerne and Zurich show, however, that problems are now arising in daily health-care practice. Regina Aebi-Müller, a professor of private and comparative law at the University of Lucerne, speaks plainly about this: "The patient decree, which attained legal certainty in the Act on the Protection of Adults, is practically useless in its present form". The researchers of Lucerne and Zurich carried out interviews with doctors and qualified nursing staff to ascertain how decisions about ceasing treatment or refusing it are actually made. It transpires that only a few people have made a patient decree. And when an acute situation actually arises, the decree is often neither available nor up to date. In such situations, it remains unclear whether the patient who is dying in an intensive care unit actually wants to be reanimated, or whether the nursing home resident suffering from advanced dementia should be transferred back to hospital and given antibiotics to treat pneumonia.

When you said 'no tubes' ...

Doctors are also confronted with patient decisions that are contradictory or impossible to respect. This does not surprise Aebi-Müller, who is studying the legal aspects of patient autonomy within the framework of National Research Programme 67 'End of life': "There are several templates for patient decrees. You can download them from the Internet, and tick

the boxes in private". Patient decrees have to be interpreted, but lawyers are better equipped than medical experts to interpret texts. Aebi-Müller gives an example of where this can end up: a patient suffering from terminal cancer had decreed that she wanted 'no tubes'. The woman in question later lost consciousness, was unable to empty her bladder, and was visibly suffering. But the nursing supervisor refused to give her a catheter on account of her patient decree. The senior consultant, however, doubted whether the patient would have meant to include this kind of 'tube'. After the nursing staff's next change of shift, he inserted the catheter himself. The woman died peacefully that same night.

If the next of kin have to make such decisions, they are often overwhelmed, or unable to agree. They don't know the will of the patient because no one took the initiative to discuss it in the family. This can be a difficult burden for partners, daughters and sons. "One in three people is traumatised by having to make a proxy decision, and doesn't know if it was what their loved one would have wanted", says Tanja Krones, Head Physician of the Clinical Ethics Committee of the University Hospital of Zurich.

Absent agreements

Despite patient autonomy, doctors still have the power to make decisions. A trend has become discernible over the past ten years in which "patients tend to be drawn more into making decisions at the end of their lives", says Milo Puhan, a professor of epidemiology and public health at the University of Zurich.

"Diagnosing the phase of dying is medically challenging"

Milo Puhan

Few doctors act on their own without discussing anything with their patient and their next of kin, or without any recourse to an earlier expression of the patient's wishes. The study carried out in Zurich and Geneva showed that in just eight percent of cases where a patient was incapable of making a decision, their doctors took decisions for them. In a further twelve percent of cases, the doctor discussed the matter with professional colleagues or with nursing staff. In a further eight percent, the patients were actually able to make decisions themselves, but their doctors still failed to discuss end-of-life issues with them or their next of kin. Puhan sees one possible explanation in it being difficult to predict

the course of a disease. "Diagnosing the phase of dying is medically challenging, and requires a lot of experience". An Australian study has shown that most conversations about medical decisions at the end of life only take place in the last three days before death. According to how a disease develops, the right moment can be missed altogether.

So, research is revealing possible areas of conflict. Aebi-Müller's conclusion is this: "Medical situations at the end of life cannot be regulated in the manner that the legislators imagine". She is convinced that any form of "absolute" patient autonomy will not function. More realistic, in her opinion, would be "relational" autonomy. At the end of our lives, when we are particularly vulnerable and suffering from pain, respiratory distress and fear, we are dependent on relationships. Aebi-Müller argues that medical staff should be given greater responsibility to make decisions, though without lapsing into old patterns of doctor-dominance. "There is no decision more personal than that relating to medical measures at the end of a life". A relationship between doctor and patient that is based on partnership, in which decisions are made together, can help support people in these situations.

Planning with counselling

The Zurich University Hospital is investigating how such support might be given. 'Advance care planning' is the name of the concept, meaning structured conversations with patients and their next of kin. Treatment teams trained in communication - doctors, nursing staff, pastoral care workers and social workers - find out in good time about a patient's wishes for treatment at the end of their life, and also about their personal views. If they become unable to make decisions themselves, what will actually be important to them? What are they afraid of? The Zurich University Hospital offers expert counselling, not just the patient decrees that can be downloaded from the Internet. "People are given evidence-based, decision-making aids", explains Krones. This means they know the concrete figures: out of 100 people who suffer cardiac arrest in hospital, even with immediate assistance, on average only 17 of them survive. And of these survivors, five to seven of them are later highly dependent on care.

Advance planning offers a better guarantee that a patient's wishes will be known and feasible, says Krones. This is also a relief to their next of kin. Such planning may also result in drawing up a patient decree, but it doesn't have to. Krones recommends a modular system that ranges from an

emergency plan signed by the doctor to instructions for what to do in a case of a chronic incapacity to make decisions. The latter could come about because of dementia, or after a stroke. "What's important is to keep checking with the patient. Because people change". Perhaps someone has been diagnosed with dementia and wants to refuse life-extending measures as soon as she can no longer recognise her relatives. But what happens if her loved ones realise that this patient seems happy despite her limitations, laughing and taking pleasure in small things? "We have to address these questions", says Krones.

'Advance care planning' is not yet widespread in Switzerland. Krones's research confirms findings made abroad, namely that advance planning both helps to meet people's wishes better, and alleviates the trauma suffered by their next of kin. It also means that fewer people are taken to hospital or are subjected to invasive treatments such as operations. This concept does not aim to lower costs, but it appears to be a side-effect. All the same, the patients don't die any sooner.

This is how we are endeavouring to come to terms with death in a professional manner. Nevertheless, it will always remain something of a mystery. In the words of Ralf Jox, a palliative healthcare professional: "Advance care planning will change nothing about the fundamental insecurity that is characteristic of our existence". But it could help to increase trust.

Susanne Wenger is a freelance journalist in Bern.

All the studies cited here are part of the National Research Programme 67 'End of life' (NRP 67). www.nfp67.ch/en/

It's naïve to think that something has to remain. Nothing remains! Everything passes. Nothing has to remain, that's the fascination of life, the beauty of creation, that everything is renewed. This cycle of becoming and passing is meaningful.

97-year old patient, suffering from polymorbidity and frailty in old age

INTERVIEW

“We’re the only ones in this niche”

Global UTM Association



An international foundation set up in Lausanne during the summer of 2016 is aiming to standardise air traffic control for drones. The General-Secretary of the Global Unmanned Traffic Management Association, Benoît Curdy, talks to us about it.

What’s the aim of your association?

We want to define the technical standards that will allow the air-traffic management of manned and unmanned aircraft. The focus is on professional and commercial journeys measured in tens of kilometres and that may involve air space in two countries.

What are you working on exactly?

It’s an extremely complex field with many different actors involved. First we are going to publish an overview of the ecosystem and the challenges to be overcome. Then we’ll look at things like drone identification: what format will the identifier take? How is it registered and communicated? The aims are sky security on the one hand, and technical interoperability on the other.

How do you set yourselves apart from the giant American association AUVSI?

AUVSI grew from the military use of drones, and is principally a lobby. We are an industrial association: we are about growing the market through the introduction of technical solutions that meet legislative requirements, not about influencing them. It’s a niche and we are the only ones working on it. If not, we’d have never got started!

Have you reached the critical mass needed for defining standards?

We’re on the right path: we’ve gone from 15 to 40 members in the space of six months. We have brought together the leading manufacturers of drones and communications systems, the suppliers of the data necessary for navigation, such as weather and map data, and the air controllers and representatives of various governments. We’re very decentralised: the regulators come with their requests, manufacturers discuss possible technical solutions, and we try to find a consensus on what is feasible.

Why did you choose Lausanne?

Because there are a number of drone startups there, not to mention NCCR Robotics, which is led by EPFL. For our foreign members, Switzerland is tiny. They can visit Lausanne as readily as they can Zurich.

NEWS

Sixty German universities boycott Elsevier

The DEAL consortium, which brings together more than 60 German research institutions, has not renewed its contract with the publisher Elsevier for 2017. According to DEAL, Elsevier’s proposal was “not compatible with the principles of open access and fair pricing”. The situation is similar in Taiwan, where three quarters of universities will boycott Elsevier in 2017. In the UK, however, the British consortium JISC has accepted an offer from Elsevier. doi.org/bwrbit.ly/2j6ZHLj

Citation frequency bears little correlation to article impact

The subjective impact of an article is only weakly correlated with the number of times it is cited, according to a study which asked 1,119 researchers to indicate which of two articles had, in their opinion, had the greater impact in their field. Their assessment matched the number of citations in 51 percent of cases (50 percent would mean no correlation). Researchers also demonstrated a strong positive bias towards their own articles. arxiv.org/abs/1612.03962

Swiss research reintegrates into Europe

Swiss institutions are once more full members of Horizon 2020, the EU’s research programme for 2014–2020. Switzerland had been partially excluded following the referendum on mass immigration of 9 February 2014. The path to full association was made possible by parliament’s ratification of the protocol extending the right of freedom of movement to citizens of Croatia on 16 December 2016. bit.ly/2hPCp1N

Springer Nature commits to open data

More than 600 journals belonging to the group Springer Nature have committed themselves to following one of the four rules on sharing research data, which range from encouragement to obligation. bit.ly/2hsRMPn

The online forum PubPeer to stay anonymous

A Michigan court overturned a researcher’s request to lift the veil of anonymity surrounding his critics on the online forum PubPeer. The comments on his research had led to the withdrawal of dozens of his articles and the cancelling of a job offer. bit.ly/2hTwx80

Europe launches a risk-capital fund

The European Commission and the European Investment Fund are launching a new fund to support startups. State funding is capped at EUR 400 million, but the private sector contribution is expected to be triple that. The “Start-up and Scale-up” proposal also aims to reduce the risk of bankruptcy among young companies and to simplify taxation. bit.ly/2j7GRz1

The University of Zurich publishes a register of conflicts of interest

Since January 2017, professors at the University of Zurich have had to disclose their potential conflicts of interest, such as sitting on company boards, engaging in political activity or participating in science councils. bit.ly/2hQuVAz

The second life of refused articles

An article refused publication by a research journal is often published elsewhere, according to a new British study. It shows that more than half of 917 articles refused by the journal *Clinical Otolaryngology* between 2011 and 2013 were published in other reviews. doi.org/bwrj

Science in exile

Many universities in Europe are trying to help refugee academics.

By Julia Richter

They worked in the labs of Aleppo and in the research centres of Kabul; they had careers as mathematicians, biologists and philosophers. They suffered persecution, lost their jobs and were compelled to flee. What happens to academics when war and persecution force them to leave their universities, their cities and their countries, leading them all the way to Europe?

Universities in different European countries are increasingly concerned with offering opportunities to refugee academics. In this regard, Germany has taken on a pioneering role. Different programmes there are trying to provide exiled academics with access to research facilities. For example, the German Research Foundation launched a package of measures in 2015 to support scientists who had fled their native countries. The Humboldt Foundation's Philipp Schwartz Initiative is also offering financial support to scientists who are in danger.

Knowledge is lost

Other initiatives aim at establishing possibilities for interaction and at integrating refugee scientists in Germany. One example of this is the platform 'Chance-for-Science' in Leipzig, which offers refugees the opportunity to come into contact with scientists at German universities. Carmen Bachmann is a professor in business taxation at Leipzig University and the platform's initiator. She is convinced

that such interactions are of great significance: "For scientists in exile, enduring a long phase of inactivity isn't just a human catastrophe. Such a situation also represents a loss of knowledge over time - because if knowledge isn't applied, you lose it". A similar approach is adopted by Academic Experience Worldwide, an initiative that enables students at the University of Frankfurt am Main to help integrate refugees in an academic environment. There, for example, refugee scientists are able to present their research topics to the Frankfurt public within the framework of a lecture series entitled 'Opening Academia'.

Compared to Germany, assistance for refugee academics in Switzerland is less well developed. Martina Weiss, Secretary General of 'swissuniversities', the new Rectors' Conference of Swiss Higher Education Institutions, believes that this is primarily because of the lower numbers of refugees in Switzerland. Walter Leimgruber is a professor of cultural anthropology at the University of Basel and President of the Federal Commission on Migration (FCM). He too confirms that the topic of refugees has not reached the same degree of attention in Switzerland as has been the case in Germany.

Nevertheless, measures have also been taken here to help persecuted scientists to get established at a university. There are eleven Swiss universities in the network 'Scholars at Risk', which was founded in

(continued on page 28)

Scientists in exile

Researchers come to Europe for all kinds of reasons, and their journey here can be complicated. Three of them tell us their story.

Out of the inferno, but without his family

**MOHAMED ALI MOHAMED (41),
GEOGRAPHER**

The images from Aleppo are devastating. It is almost unimaginable that the city had a functioning university system until only recently. Mohamed Ali Mohamed can tell all about it. Until September 2015 he worked as a lecturer in cartography at the Geographical Institute of the University of Aleppo. He lived in the Syrian city with his wife and three children until their apartment was completely destroyed in a bombing raid. But he did not want to interrupt his work at the university – after all, he had to provide

BERLIN, GERMANY

ALEPPO, SYRIA

LAUSANNE,
SWITZERLAND

When paradise turns to hell

**GUILAIN MATHÉ (34),
POLITICAL SCIENTIST**

Guilain Mathé's academic career is not like other people's. He has spent much of it on the run. His commitment to human rights and his research into civilian massacres during the civil wars that have devastated the Democratic Republic of the Congo since 1996 made him into a *persona non grata* in the eyes of the Congolese government. In 2008, he left his homeland. "I was getting constant death threats because of my research", he says.

After extended visits to Senegal and Côte d'Ivoire, he was given a post at the University of Lausanne in 2011 through the network 'Scholars at Risk'. It was financed initially by a scholarship from the University, then later by the Gerda Henkel Foundation in Germany. In 2014, Guilain Mathé tried to return to his home country. "It was a nightmare". He was arrested in Kivu by the state security services. He was intimidated and threatened on account of his research into the rebellions



carried out by the National Congress for the Defence of the People (NCDP) and its follow-up group M23. He managed to flee across the Ugandan border and travelled back to Switzerland, where he filed an application for asylum in May 2014, which was granted in 2015. Meanwhile, Mathé has been studying for his doctorate at the University of Lausanne and would like to complete his thesis about the role of non-state actors in peace-building processes by 2017.

Although Mathé feels very much at home in Switzerland, he misses his native country. And he misses his family. "The Congo could be paradise on Earth". Sadly, the country has instead become a hell, on account of corrupt leaders and its exploitation by multinational companies. "C'est dommage", says Mathé.

BUKAVU, DEMOCRATIC
REPUBLIC OF CONGO

for his family. But the civil war meant he lost his job. He also feared that he would be called up into compulsory military service.

In late 2015 he managed to enter Turkey illegally. He had lived in Berlin from 2004 to 2010, completing his doctorate at the Humboldt University. This fact enabled him to get a new, one-year contract as a guest researcher from January 2016 onwards. The German Embassy in Ankara accordingly gave him a visa, and he reached Berlin four weeks after leaving Syria. Since July 2016 he has been attached to the Humboldt University, thanks to a scholarship from the Philipp



Schwartz Initiative, which enables him to continue his research on geographical information systems. His family is currently in a refugee camp in Syria, because the borders to Turkey have since been closed.

It is difficult for him to concentrate on his research at present. "I'm constantly afraid for my family". Mohamed hopes that the war in Syria will soon be over. Then he wants to return home and play an active role in rebuilding his country.

LAUSANNE,
SWITZERLAND

'Scholar at risk' – because of a signature

AYSE DAYI (45),
SOCIOLOGIST

"In Istanbul, every day is a little adventure", says Ayse Dayi. She misses her native city – and yet she can't stay there anymore. Dayi had an assistant professorship in the Department of Psychology at Marmara University in Istanbul, where she worked in the fields of gender studies and women's health.

In January 2016, she signed a petition organised by the Turkish group Academics for Peace against the military operations and human rights violations carried out by the Turkish army. Many researchers who signed this petition were interrogated and arrested. Dayi lost her job and was put on a blacklist. This made it impossible for her to find another job in Turkey.



ISTANBUL, TURKEY

Thanks to a contact of hers, she managed to come to the University of Lausanne in September 2016. There she was given a two-year contract to work within the framework of the 'Scholars at Risk' programme. Dayi is very grateful to be in Switzerland. In Lausanne, she is part of an international research project investigating the impact of neoliberal structures in healthcare on the reproductive rights of women. Dayi doesn't know if she wants to return to Istanbul. In Turkey, universities have stopped being places of critical thought, she says. "The oppression and violence in my home country are so intense that just asking the question 'How are you?' has become absurd".

“A long phase of inactivity also represents a loss of knowledge – because if knowledge isn’t applied, you lose it”

Carmen Bachmann

Chicago in 1999 with the aim of protecting imperilled scientists, preserving academic freedom and upholding human rights. This network has over 400 member universities across the world that are working to realise its goals in different ways. For example, a member of the network can offer jobs to scientists who are in danger, or it can organise events and conferences to help spread information about the problem. The universities of Lausanne and Lucerne have already appointed refugee scientists to their staff. Other universities, such as Bern and Zurich, have thus far restricted their activities to propagating information and raising people’s awareness.

Modest career perspectives

Despite these initiatives, opportunities are limited for refugee scientists to get a post at a Swiss university. Why is this? “Academic posts are often scarce, and competition for them is fierce. This certainly doesn’t make things easier”, says Christin Achermann, a professor in migration, law and society at the University of Neuchâtel and the project leader at the National Center of Competence in Research ‘On the Move’. Martin Reichlin, the Deputy Head of Information and Communication at the State Secretariat for Migration, says that there are also practical aspects to the problem. For example, when people flee they are sometimes unable to take their degree certificates with them to their new host countries. Walter Leimgruber of FCM also acknowledges that there are language problems. And he sees a further problem in the significant professional and qualitative differences in training and education that exist in the various homelands of these refugee academics. “In order to integrate successfully, academics need the means to pursue further training. They have to be able to take appropriate language courses and acquire additional qualifications”. And it is not the universities, but the cantons that are responsible for this. Leimgruber is critical of the

cantons’ attitude: “For them, a handful of academics is simply an irrelevance”. This is why he proposes adapting integration services specifically to suit academics.

There are more opportunities for academic integration when it comes to students who have arrived as refugees in Switzerland. The Association of Swiss Student Bodies (VSS) has set up a project entitled ‘Perspectives – studies to integrate refugee students into the Swiss university system’. Martina von Arx is in charge of it, and she is delighted at how much students are getting involved: “The big demand and the positive feedback about our current projects show that we are on the right path”. At various universities – such as in Basel and Geneva – projects have meanwhile been established that allow refugees to attend lectures as guests. One disadvantage, however, is that these programmes thus far do not enable anyone to progress to a recognised degree, and they are also only available to a restricted number of students.

There are no integration services in Switzerland specifically for academics

So, there are still several obstacles to be surmounted before refugee researchers can be integrated successfully in Switzerland. Just how important it is to set up specific support for refugee academics is proven by the historical experience gained from scientists who fled from the Nazi regime. They did not just escape with their lives; they also brought fresh knowledge and innovations to their new host countries. And academic migrants sometimes also bring fame and honour with them. Of the 21 Swiss recipients of a Nobel Prize in the natural sciences, ten of them were born in other countries.

Julia Richter is a journalist in Bern.

Many different programmes, especially in Germany

- The **Philipp Schwartz Initiative**, run by the German Humboldt Foundation, helps imperilled scientists.
- **Chance-for-Science** provides contact with researchers at German universities.
- The **Council for Assisting Refugee Academics** (Cara) does what its name says. It was founded in 1933 in reaction to increasing discrimination in Nazi Germany.
- **Scholars at Risk** campaigns for research freedom and human rights.
- **Science4Refugees**, an initiative of the European Commission, facilitates integration at European universities.
- **Academic Experience Worldwide** promotes the academic integration of refugees.
- The **Scholars Rescue Fund** offers financial support to scientists who are in danger.
- The **Initiative of the German Research Foundation** enables projects to apply for additional funding in order to appoint exiled scientists.

“There’s no good time to present inconvenient findings”

Dominik Hangartner is an expert on migration. His research has covered Swiss citizenship proceedings at town meetings, the labour market integration of asylum seekers, and prejudice towards foreigners. He takes all the media attention in his stride. *By Pascale Hofmeier*



Manu Friederich

Communicating his results is all part of his research, says Dominik Hangartner.

What’s it like for a researcher to be in the political limelight?

I’m aware that we are researching into topics that are controversial – such as how long people should have to wait before they can apply for Swiss citizenship. Other policy matters, however, are astonishingly free of controversy. Such as the positive consequences of shorter asylum procedures. In a democracy, it’s important to be able to demonstrate the pros and cons of different policies, and to do so with political independence. Our field of research is emotionally charged, but we aim to provide cool-headed analysis and objective instruments so that people can form fact-based opinions. The visibility of migration topics in many countries has meant an increasing interest in our work in recent years.

How do you cope when politicians appropriate your research results?

I have two tasks as a researcher. First, I have to make accurate analyses, identifying causes and effects. For example, if we shorten an asylum procedure by two months, it means refugees can begin working sooner. This costs the state less and promotes integration. Secondly, I have to ensure that our results can be understood by both experts and laypeople in the way that we have quantified them. After all, our research is funded by people’s taxes. The better we succeed in that, the less room there is for misinterpretation. We can make suggestions for better integration policies, but it’s up to politicians, administrators and the voters to decide if and how our suggestions are to be put into practice.

Have you ever considered withholding results for fear they’ll be misunderstood?

This is one of the taboo topics among researchers. There is rarely a good time to publish inconvenient findings. Speaking for myself, I have never been in that kind of situation. But I think I have a pretty thick skin.

All the same, your work prompts all kinds of reactions. Do you read the commentaries in the social media?

Sometimes. But that’s not necessarily a meaningful way to spend your time.

What about you: where do you stand on the political spectrum?

My interest in migration as a topic is partly due to my own biography. But this has no impact on the scientific process by which I conduct my research, or on the results I get. I want to understand what works and what doesn’t. The analysis itself is a neutral process. Nor do I have any incentive to gloss over anything. Our society has political instruments that can be expensive and well-meaning, but that actually achieve nothing. In such cases, a country has to review what it’s doing.

Should you intervene more in public debate?

My research takes place in the midst of our society. So I have to communicate my results to everyone who’s affected, which in this case means all those who are involved in the field of migration. We also choose our communication partners systematically. We have presented our results on labour market integration to the European Parliament, and showed the representatives of different countries how they can make data available for further studies.

Your projects are international in focus, though you’re Swiss yourself. Does this help you to remain more independent?

It helps. But what’s relevant to Switzerland also meets with interest abroad. Lots of European countries were interested in our results on accelerating the asylum process. For example, we were asked about adapting it to the Finnish context. Our public relations work means we get many requests from countries outside Switzerland. This

can help us to build up pressure for researchers to get access to data from those countries that had previously kept it under wraps.

Pascale Hofmeier is a science editor at SNSF.

The most recent findings

- A survey conducted among 18,000 people in 15 European countries shows that their preferred refugees are young, Christian, female, and well-educated; Muslims tend to be disliked. *Science* (2016)
- Although refugees in Switzerland can work while waiting for asylum, the length of the asylum process hinders the start of their careers. *Science Advances* (2016)
- Migrants integrate better when they are allowed to get citizenship. *Proceedings of the National Academy of Sciences* (2015)

The migration expert

Dominik Hangartner is a political scientist at the London School of Economics. In August 2017 he will be appointed Associate Professor of Public Policy at ETH Zurich. He is Faculty Co-Director of the Immigration Policy Lab with branches at Stanford University and the University of Zurich, and Head of the Asylum Policy and Refugee Integration Project at the National Center of Competence in Research (NCCR) ‘On the move’.

Retirement colonies

Many retired Europeans have emigrated to the Costa Blanca, in Spain's Alicante region. The sociologist Marion Repetti has been there to study the effects of geographical distance on family solidarity.



“ I arrived in Xàbia in August 2016. It's a small coastal resort town in Alicante, and home to myriad retirees from northern and central Europe, especially the United Kingdom. In one neighbourhood in particular the residents speak only English and the shops all have English names. It is, in effect, a form of colony.

There's even a commonly heard joke in Xàbia: during negotiations over Gibraltar, the former Prime Minister Margaret Thatcher is said to have remarked: 'I'll give you Gibraltar back, but leave us Xàbia!'

Intragenerational bonds

In Europe, the dominant model of society dictates that solidarity among individuals is more the preserve of the family than of the state. There are expectations of retirees, such as providing support to the family, typically by looking after grandchildren.

As they reach a grander age, they can then count on their children to care for them. This model is based on the members of the family all living in relatively close proximity, which led me to wonder what effect distance has on family solidarity.

I'm following a post-doctoral programme at the University of Manchester (UK) and Virginia Tech (USA). Coincidence conspired in leading me to Xàbia. For many years, I've been studying the issues stemming from ageing, and I knew, thanks to the literature, that there were many retirees in Alicante. As I knew no one at all who'd gone there to set up for the long haul, I contacted a number of organisations and centres for retirees, including a regional association of Swiss retirees. Xàbia just happened to be the home of the first people I came into contact with. They put me in touch with other retirees, who had me added to some Facebook groups.



Twice a day, the local singing club in Benidorm, Spain, invites people to Levante Beach for a singalong of well-known folksongs from all over the world. In the local towns of Xàbia and Dénia, the postdoc Marion Repetti is interviewing retirees from northern and central Europe about their relationships with their families back home.

Photo: Keystone/DPA/Manuel Meyer

This allowed me to extend my network to the neighbouring town of Dénia.

I first travelled there for a month-and-a-half stay, before returning once more in January 2017. On this second trip, my husband and two children came with me. During my stay, I spoke to many retirees either living in Xàbia or spending part of the year there. I met with them both in public and in their homes. Through in-depth interviews, I was able to analyse the nature of the family bonds they maintained with those living far away.

Don't sever ties

According to the people I interviewed, finances were a significant factor in the decision to leave home. They considered that they could improve their living conditions during their retirement by migrating abroad. In fact, some were in a financial situation that left them very little choice.

Given the differences in purchasing power, some retirees were able to buy large houses, sometimes even with a pool. They can go out and eat in restaurants, which would not necessarily have been the case in the countries they had left behind. They were also aware that their presence was a helping hand to the regional economy, reinforcing their idea that they were legitimately at home there. They were open to talk about their situations and were proud of what they had achieved. They no longer felt like they were 'mouths to be fed'.

The literature on the topic generally considers retirees as individuals who leave to enjoy their freedom, particularly with regard to family duties. I found the opposite. First, they had chosen Spain over Thailand and North Africa, so as not to be too far from their families. They agreed on the need to be available in case of emergency. They also see it as important to be

able to receive family members as guests and had the impression that they could offer their children and grandchildren an enjoyable setting for their holidays, bringing them further value. In some cases, the departure had caused tension with the children, who had expected them to share in the daily chores. In other cases, they received the support of their families. ”

Interview by Benjamin Keller

Digital uncertainty

Populism on the Internet could potentially undermine democracy in Switzerland. But it's only since its recent electoral successes that 'digital populism' has become a focus of public attention here – and also a focus of research.

By *Martin Zimmermann*

In Europe, 2017 is a 'super election' year. There are going to be elections in the EU's two big players, France and Germany, and in several other countries. But this time everything is different. Since Donald Trump's success in the US presidential election, a spectre is haunting Western democracies: digital populism. Controversial discussions have now been taking place about whether there is a connection between the success of the populists and their social media campaigns.

Researchers are hesitant about drawing conclusions. At the Institute of Communication and Media Studies (icmb) at the University of Bern, Thomas Häussler warns against blaming Facebook and other social media for the successes of the populists. "Of course populists make clever use of social media – here in Switzerland, that primarily means the Swiss People's Party (SVP)", says Häussler, who is researching into political communication and online mobilisation. "But for them it's just one more channel of communication".

The classical media still have more of an influence on the political opinion-forming process, he says. In Switzerland, that's mostly the newspapers. Elsewhere, it's the TV. If we were to pull the plug on Facebook tomorrow, the political landscape would not change fundamentally, he says. The political polarisation that already exists would not disappear overnight.

A direct line to the people

Fundamentally, however, online platforms and populism are indeed an ideal combination: "Populists look for a direct line to the people", explains Sven Engesser of the Institute of Mass Communication and Media Research at the University of Zurich. At the National Center of Competence in Research (NCCR) 'Democracy', he is researching into populism and the mass media. "Facebook and Twitter enable them to feel the supposed pulse of the people, and to convey their messages to them without the detour of using the classical media".

The role of social media in the rise of populist movements has until now been subjected to remarkably little scholarly re-

search, says Engesser. Research into digital populism is made more difficult because there is no generally recognised definition of 'populism'. This is itself in part a result of the heterogeneity of the parties and movements generally described as being 'populist'.

Offline populism online

Engesser and other researchers at the University of Zurich have been engaging with the content that populists from Switzerland, Austria, Italy and Great Britain have been spreading on the Internet. What they all have in common is that they see themselves as the 'true' representatives of an idealised people that is in constant conflict with supposedly remote elites. The digital content of the populists largely corresponds to their offline content. Whereas left-wing populists tend to attack the economic elites – thus large corporations and banks – the right-wing populists fire off tweets, make posts and publish online articles against political elites and migrants. Criticism of the traditional mass media mostly comes from the right wing.

"In extreme circumstances, this way of thinking undermines democracy"

Thomas Häussler

In this rejection of mass media, Thomas Häussler sees an important characteristic of populism in the Internet. It is particularly pronounced in the debate about the so-called 'lying press' in Germany. "In historical terms, the public prestige of journalists was never very high. But in recent years it's sunk even further".

The strategic value of insecurity

The media now receives widespread, basic criticism of a kind that was unheard of for many years. And the populists are turning this loss of trust to their advantage. Häussler says: "They accuse the traditional media of being part of an elite that is

conspiring against the people and intentionally trying to manipulate them". This accusation is diametrically opposed to the values propagated in journalism's codes of practice, such as independence and a responsibility towards the public. It is not surprising that many populist parties – in Switzerland, that's first and foremost the SVP – are demanding the downsizing or even the abolition of public service broadcasters, because they are supposedly the standard-bearers of the elite.

In its online expression, however, this anti-elitist stance leads precisely to a dissolution of journalistic standards. Suddenly, dubious sources such as the Swiss conspiracy theorists' portal 'Alles Schall und Rauch' ('All hollow words') is afforded the same journalistic significance as a *Neue Zürcher Zeitung*. Gut feeling and 'healthy common sense' count more than expert knowledge and verifiable facts. It has even become easy to spread fake news by means of fictitious online articles that mimic the style and layout of the traditional mass media. Engesser and Häussler suspect that a conscious political strategy lies behind this. People who feel insecure tend to seek support from charismatic leaders and simple ideologies. And this is exactly what the populists offer.

Is nothing true anymore?

This erosion of journalistic standards can have a long-term negative impact on political processes. Under these circumstances, the media cannot fulfil their role as the fourth estate, with their function of critique and oversight. If everything is relative, it becomes ever more difficult to form a fact-based opinion and to debate political topics. "You then get stuck in the meta-discussion as to whether the basic information presented by the media and experts is actually true – indeed, whether anything at all that the media report is true", says Häussler. "In extreme circumstances, this way of thinking undermines democracy".

This relativisation of facts is promoted even further by so-called echo chambers or 'filter bubbles'. These two concepts have become common-place and are used to de-



Unverifiable assertions and manipulations are as dangerous to democracy as flooding to a city. No wonder Helvetia by the Rhine in Basel looks pensive.

Photo: Keystone/Branko de Lang

scribe the tendency for people to surround themselves on the Internet with others who think similarly, and who engage in mutual confirmation of their attitudes. This phenomenon is not new, when one considers that newspapers faithful to specific parties dominated the Swiss scene until the 1960s. Thomas Häussler agrees, but he points out: “If you wanted to know that there were other opinions apart from the one in your party newspaper, you just had to take a step back at the kiosk for you to see the newspapers of the other parties”.

Taking a step back - adopting a neutral, bird’s eye-view, as it were - is no longer possible in the Internet, says Häussler, because with every new click, its users are constantly changing their communicative network. Algorithms use their activity to ensure that users see content that corresponds mostly to their own presumed worldview. And this trend is further intensified by the micro-marketing companies that have specialised in tailored Internet advertising.

When the Internet ‘flows over’

Up to now there has been no empirical proof that filter bubbles in the Internet have helped the populists to electoral victory. Both Häussler and Engesser assume that there is a so-called spill-over effect, meaning that, by reporting on tweets, blogs

and Facebook entries, the traditional media act like continuous-flow water heaters. They merely serve to amplify the impact of those tweets and blogs, far beyond the actual bounds of social media.

People who feel insecure tend to seek support from charismatic leaders and simple ideologies. And this is exactly what the populists offer.

To survive in the battle for coverage (and thus for advertising revenue), the classical media are increasingly orienting themselves to social media. “Drama, emotions, clear messages - everything that populists offer in tweets and in Facebook posts can get more people to read an online newspaper article, for instance”, says Engesser. These statements often cannot withstand fact-checking. But once they’ve been disseminated, it’s difficult to disprove them. Although the populists and the supposedly lying mass media are at loggerheads, paradoxically they profit from one another,

Engesser adds. The tirades of the populists provide the clicks, while the mass media spread their messages.

This problem has become especially virulent in countries where politics is highly polarised, and where media supportive of the state (and thus, in the eyes of the populists, allied to the ‘elites’) are unable to assume a moderating function. A paramount example is the USA, where the public service broadcasters are very weak. During the presidential election, the US mass media simply fell short with their cultivation of indignation, says Thomas Häussler. “By taking up every hair-raising tweet by Donald Trump and disseminating it in their quest for clicks and advertising, they ultimately promoted his policies too”.

Martin Zimmermann is a freelance journalist in Bern.

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S. Engesser et al. Populism and social media: how politicians spread a fragmented ideology. Information, Communication and Society (2016)

Signs for words

Many of Switzerland's estimated 600,000 hearing-impaired people communicate in sign language. This is also of great interest to researchers.

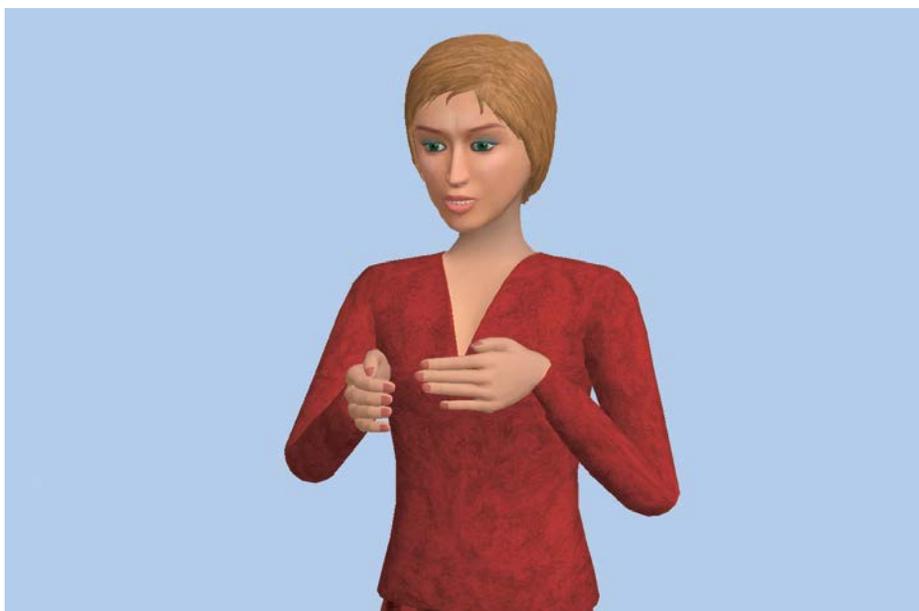
By Astrid Tomczak-Plewka

Sign languages are natural languages. They are developed and used in a linguistic community just like spoken languages. In Switzerland, there are three in use: Swiss-German, French and Italian sign languages.

Modern linguistic research into sign languages began in the 1960s with studies in the USA and the Netherlands. In Switzerland, Penny Boyes Braem founded the Center for Sign Language Research in Basel in 1982 as a private, non-profit organisation. "Back then, no other institution in Switzerland was prepared to promote research into these languages, which were looked down on by some", she explains. "For linguists, however, the descriptions in these languages, which are produced and perceived visually, are highly interesting because they often shed new light on traditional language theories". For example, in sign language, visual iconicity is present on all levels - in other words, there is a visible relationship to linguistic expressions. This casts a 'long shadow' over the linguistic principle that the relationship between the linguistic sign (i.e. words) and their meaning is arbitrary in all human languages. For example, the words for the concept 'tree' are very different in unrelated languages. But in many sign languages of the world, the signs for 'tree' offer a pictorial aspect of the form of a tree.

Compulsory sign language

Today, sign language is being investigated at several institutions in Switzerland, such as at the University of Applied Sciences of Special Needs Education (HfH), at the University of Zurich and at the Zurich University of Applied Sciences in Winterthur (ZHAW). These projects need researchers who have themselves mastered sign language. One of them is Katja Tissi of the HfH. She has been deaf since birth and learnt her sign language from her older sister, who is also deaf. "As a child I felt bad when I used sign language", she recalls. Until 1980, Swiss experts concentrated on sending the hearing-impaired to hearing and speech training sessions, and they communicated



Anna the avatar translates platform announcements into Swiss-German sign language. Image: University of East Anglia/University of Zurich, Institute for Computational Linguistics/trainlate

mostly via lip-reading. But on a visit to the USA, Tissi discovered that sign language was a subject of scientific research over there. "When I saw that sign language was recognised, it opened up whole new worlds to me, and gave me self-confidence".

"Sign languages often shed new light on traditional language theories"

Penny Boyes Braem

Sign language research has profited from developments in computers and multimedia. What is of central importance is image recognition. "Just like people who can hear, more and more hearing-impaired people are using the Internet and social media" explains Penny Boyes Braem. In order to communicate via the Internet, the hearing-impaired often produce video clips in sign language. That way, they can be easily identified - unlike the users of spoken language, who can remain anonymous thanks to their use of written communication. This is why researchers are developing technologies to recognise signs on video, and then to have these translated back into gestures by a completely anonymous avatar. One initial step in this direction is the 'Smile' project (Scalable Multimodal sign language technology for sign language Learning and assessment). It is being run by the Idiap Research Institute in Martigny in collaboration with the HfH and the University of Surrey (UK). This project is developing

automatic sign language recognition technology that will offer learners feedback on their use of Swiss-German sign language.

Translating announcements

Automatic machine translation also plays a role in the doctoral research of Sarah Ebling at the University of Zurich. Hearing-impaired people cannot understand the platform announcements given at train stations. So Ebling has developed a system that enables the announcements to be shown by an avatar in Swiss-German sign language (DSGS) on a smartphone.

Further research areas include the signals of the hands and the face as well as the cognitive processes involved when using sign languages. "Various studies have shown that coordinating a manual gesture with a non-manual component is a great challenge for adult learners who can hear. We still know far too little about the functioning of this modality-specific language acquisition", explains Tobias Haug, the director of studies and a researcher at HfH. In order to investigate this, the HfH is planning a project for a so-called 'learner corpus' in DSGS. "The goal of this learner corpus is to collect data on learners over a certain period of their DSGS acquisition. We want to find out, for example, the typical difficulties they encounter when learning a sign language".

Astrid Tomczak-Plewka is a freelance journalist in Bern.

Texting against the binge

A 17-year-old schoolboy is sitting in a pub when a text message arrives on his smartphone. “Hi Mario. You’re not someone who drinks alcohol just to fit in with the rest. Great! That shows you’re strong, and it can impress others!” The text is intended to help him say ‘no’ when his friends try to get him binge-drinking. It’s been sent by the team of researchers led by Severin Haug, who works at the Swiss Research Institute for Public Health and Addiction at the University of Zurich.

Their programme is called ‘MobileCoach Alcohol’ and was tested during a study on some 1,000 students at high schools and vocational schools in the cantons of Zurich and Bern. The project members visited 80 classes and got the students to answer questions on tablets about their alcohol consumption. Half the classes were a control group and so were not further involved. But for the other half, the researchers got immediate feedback from their computer program about the students’ alcohol consumption. For every participant, the program also generated a text message that was sent over the next three months. “The more the messages are individualised, the more likely it is that they’ll actually read the information”, explains Haug.

The program is primarily intended to curtail so-called binge-drinking – the consumption of five or more alcoholic drinks at a single time (for women, the number is four or more drinks). In the month before the survey began, 47 percent of the students had indulged at least once in such binge-drinking; in the month afterwards, it was 41 percent.

This electronic support is now being developed further and is going to be offered in other cantons. Because everything runs more or less automatically, the program isn’t expensive, even when many text recipients are involved. “Ultimately it makes no difference if you do it with ten young people or ten thousand”, says Haug. *Jochen Paulus*

S. Haug et al.: Efficacy of a Web- and Text Messaging-Based Intervention to Reduce Problem Drinking in Adolescents: Results of a Cluster-Randomized Controlled Trial. *Journal of Consulting and Clinical Psychology* (2016)

Severin Haug



This program texts teenagers when they’re out drinking.



Cutting back on under-used second homes in holiday resorts has an impact on first homes too.

Unforeseen consequences of the second-home initiative

Since the building of new second homes became forbidden in tourist areas, first homes have become 12 percent cheaper there. No such trend is observable in other municipalities. This surprising effect has been identified by the economists Christian Hilber of the London School of Economics and Olivier Schöni of the University of Bern. They compared apartment prices before and after the initiative across the whole of Switzerland. “The effect is astonishingly robust and verifiable, even if we exclude the big cities”, says Schöni. Furthermore, there is no indication that potential buyers have moved to neighbouring towns.

The price effects are different for first and second homes, so the authors have deduced that they are not interchangeable. There are presumably two reasons for this. The first is the difference in construction methods employed for chalets and traditional homes; the second is their location. Whereas tourists want to live close to the ski lifts, locals want to live a short distance from schools and the shops.

The authors don’t see any positive impact from the lower house prices in the tourist areas. “Rents are going down to be sure, but that’s only because the ban on second homes is having a negative impact on the local labour market and on future prospects”, says Hilber. Career opportunities for the locals are deteriorating. This means that people are less willing to pay as much for property, and ultimately it reduces their assets. The authors reckon that in the long term, many locals will sell their houses to investors. In this way, new holiday accommodation will emerge, but in a manner that’s legal again. *Anne-Careen Stoltze*

C. Hilber & O. Schöni: The Housing Market Impacts of Constraining Second Home Investments. University of Bern & London School of Economics. CRED Research Paper No. 11 (2015)

Gone goose

It takes practice to learn how to hold a fountain pen properly so that it doesn’t drip, smear or scratch. But the steel nib only established itself as a writing tool in Europe in the 19th century. For the thousand years before this, writing was done with bird feathers – mostly goose quills. And they were no less vexing to use properly. Not everyone mastered the posture and finger position necessary, let alone the art of sharpening the quills. The German poet Annette von Droste-Hülshoff complained in a letter: “Happy is he who can write with a goose quill! I can’t, because I don’t understand how to cut them ...!”

Martina Wernli, a literary scholar at the University of Neuchâtel, is investigating the history of goose quills from the Middle Ages to the 19th century. She is searching for mentions of the feather in various sources – such as in sonnets by the Italian Renaissance poet Petrarch, in novels by Jean Paul and in the Baroque poems of Catharina Regina von Greiffenberg. Wernli’s aim is not merely to understand a literary motive or its metaphorical significance: “I am also investigating the feather as an object with its own materiality”. To this end, she is consulting historical guides to sharpening quills, and instructions on body posture when writing.

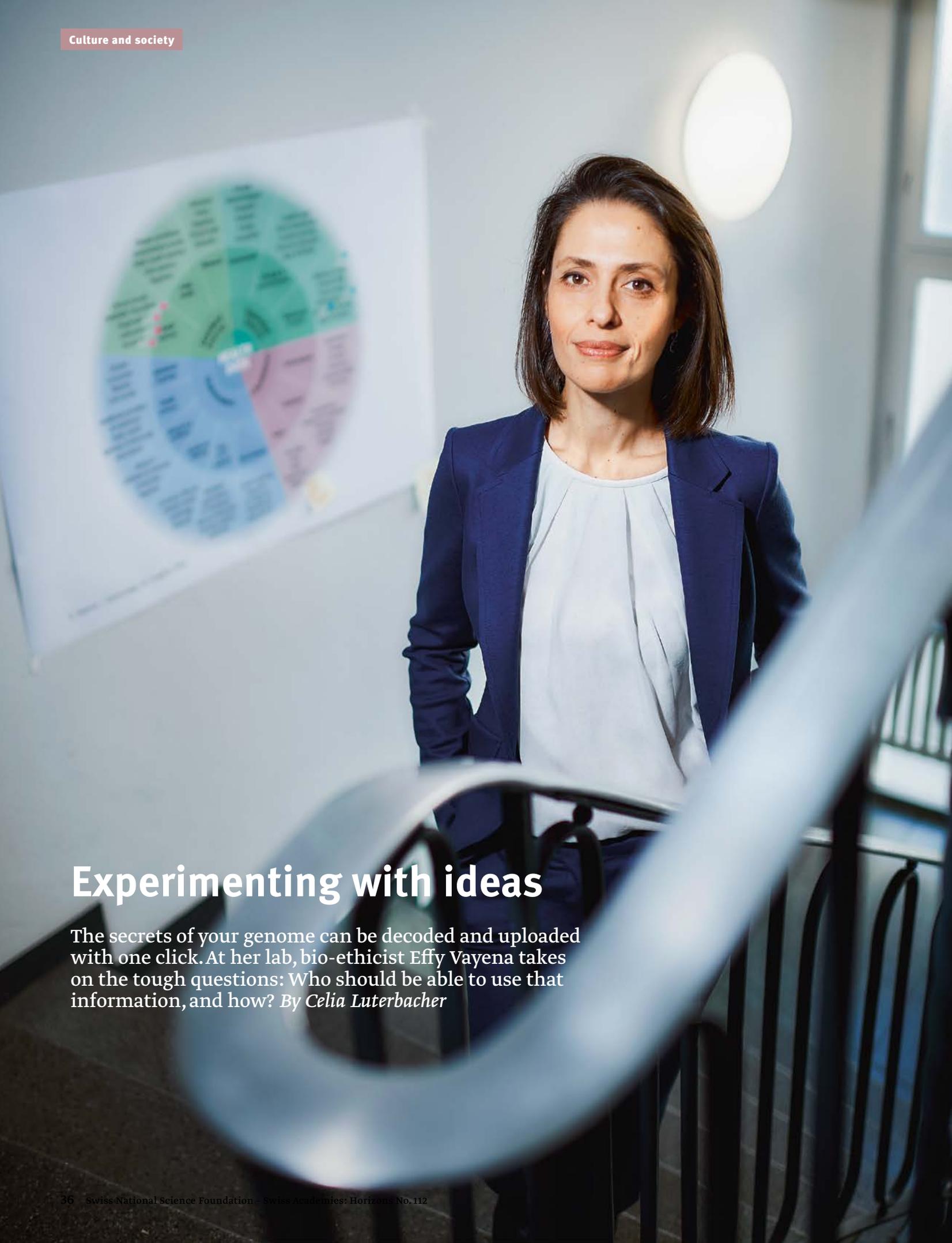
Scholarship has hitherto neglected the quill – unlike ink, parchment and paper. And they seldom surface during archaeological digs, because they had been used up or rotted away. Wernli’s analysis does more than just bring the goose quill into the present day. For the first time, it also links together different perspectives of writing as art, culture, and technology.

Kathrin Zehnder

Habilitation project ‘Feder lesen. Eine Literaturgeschichte des Gänsekiels von den Anfängen bis ins 19. Jahrhundert’



18th-century writers needed help in learning to use goose quills.



Experimenting with ideas

The secrets of your genome can be decoded and uploaded with one click. At her lab, bio-ethicist Effy Vayena takes on the tough questions: Who should be able to use that information, and how? *By Celia Luterbacher*

Most of Effy Vayena's adult life has been spent far from the place where she grew up on the Greek island of Lefkada. After earning her Bachelor's degree in history in Athens, she embarked on a career path that would take her from the US to the UK, Myanmar and Mongolia. Now based in Zurich, she still manages to get back to Lefkada every summer to visit her family, and do some water-skiing with her two daughters. "It is so beautiful and sunny there - I think growing up in such a sunny place, you are naturally filled with optimism", she says.

Optimism would seem to be a beneficial character trait for someone whose job is to develop answers to some of the most difficult ethical questions facing society today. As a professor of health policy and founding head of the Health Ethics and Policy Lab at the University of Zurich, Vayena studies the regulatory challenges that accompany advances in health and medical technology.

She studies the privacy, fairness, and freedom of choice issues that today's regulatory frameworks are simply not equipped to address. Genomics and gene sequencing, for example, allow us to know more about patients' futures than ever before. "But what information should we share with them, or with others? Should this information remain private or be used for the greater good?" Vayena asks.

Designing research (and cars)

Vayena hasn't always been in academia. She first came to Switzerland in 2000 to work for the World Health Organization (WHO) in Geneva.

"I started out studying history and the history of ideas, but I became more interested in the controversies I encountered in ethics and medicine - especially those relating to assisted reproduction and genetics".

At the WHO, Vayena researched reproductive health in developing countries, focusing on infertility. While not usually associated with developing nations, many of which suffer from overpopulation, infertility impacts health and wellbeing in these regions just as it does in developed countries, Vayena explains. She studied how new reproductive technologies could alleviate suffering in these regions, and whether such technologies have a place when health resources are limited.

As part of this work, Vayena travelled to support local groups in implementing ethical research programmes and practices. She says her experiences left her in awe of the researchers she met. "When I was in Myanmar, I was so impressed by how

candidly they spoke about their challenges, their lack of funding, the ethical norms they valued, and human rights", says Vayena. "I was inspired by their resilience and determination to improve their research and their lives, and to defy obstacles. They would build their own cars to get around - I rode in one of them".

Following the birth of her first daughter, Vayena decided in 2008 to return to academia via a habilitation programme in bioethics and health policy at the University of Zurich.

Citizen science: a democratic study

Another area of interest for Vayena is citizen science. Although the movement isn't new, smartphones and the Internet have allowed participants to share more data more quickly and more widely than ever before. For Vayena, Switzerland is an ideal place to study citizen science questions, such as: how can we protect participants and their data, and engage everyone in decisions about science?

"It's really interesting for me to be doing my research in Switzerland, because of its tradition of direct democracy", she says. "I'm interested in learning how we can create new norms to help manage problems of ethics, health and data. And how do we create norms? Ideally, through reflection, democratic participation and deliberation".

"Having lived in so many different places, I've acquired the ability to look at the same problem from the perspective of many different cultures"

Vayena can now participate in such deliberation, having obtained Swiss citizenship last year. As luck would have it, her first trip to the ballot box included a vote on the regulation of pre-implantation genetic diagnosis - a controversial procedure that involves the genetic testing of human embryos in vitro, before they are implanted in a woman's uterus. Vayena voted in favour of revising Swiss law to allow the procedure, which was the choice accepted on 5 June 2016.

A democratic model also prevails in Vayena's lab: "I like to create an informal setting without too much hierarchy; we work hard and laugh a lot", she says. "In my lab we don't use pipettes. I like to think of it more as experimenting with ideas".

Next year, Vayena and her team will begin work on an SNSF-funded project combining big data, ethics and health. Vayena is also at the forefront of the new Swiss Personalized Health Network (SPHN), a CHF 70-million National Support Initiative coordinated by the Swiss Academy of Medical Sciences and designed to accelerate personalised health through harmonised frameworks for medical data in Switzerland - and potentially beyond it.

And if she still has time after that? Vayena says that long-term, she'd like to study the influence of artificial intelligence on medical research and health care.

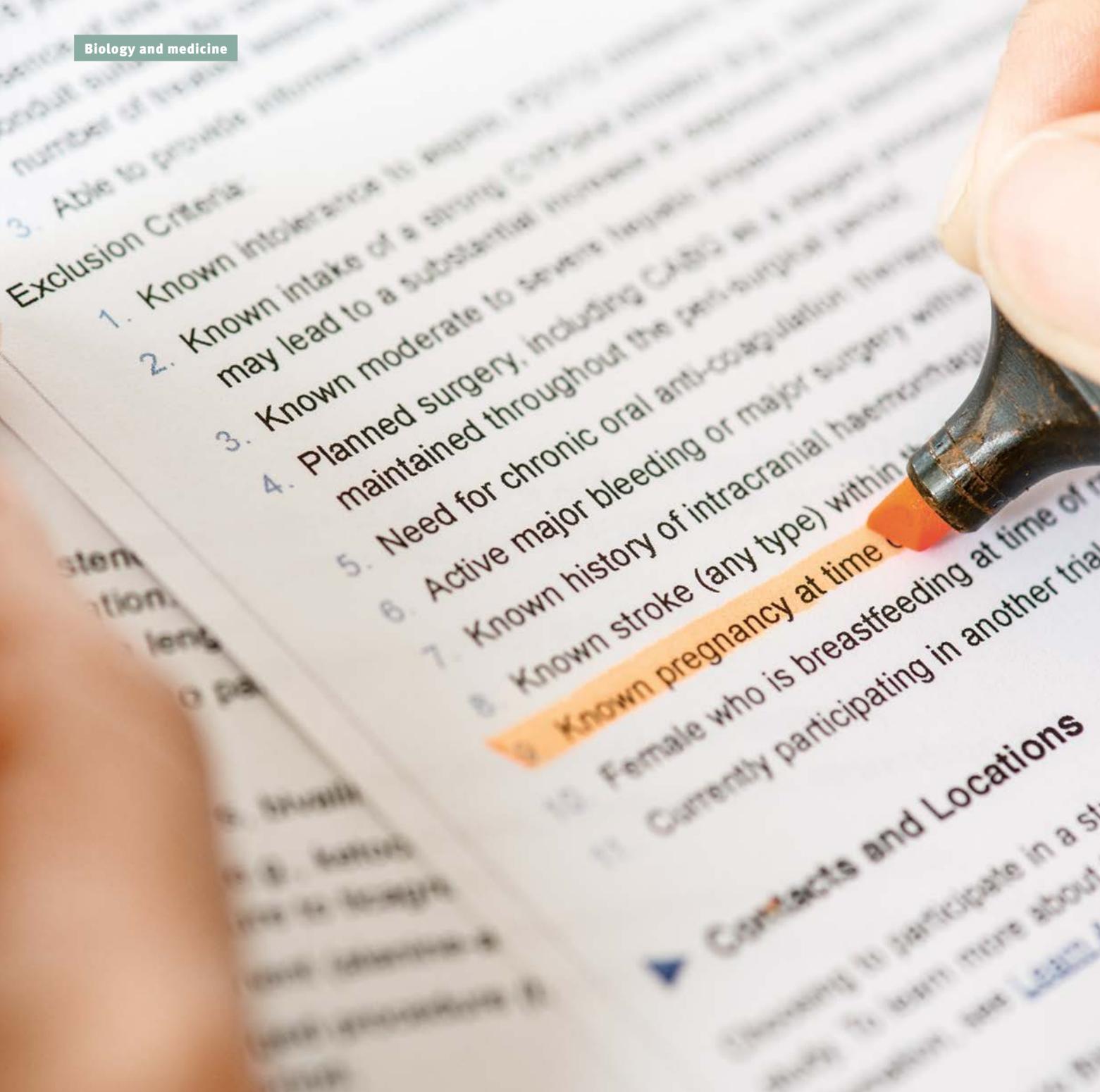
But for now, she's content to find spare time to spend with her daughters.

"I talk to them a lot. They're growing up trilingual - speaking German, Greek and English - so I answer a lot of questions! And every summer we go back to Greece. They are better on the Swiss ski slopes than me, but at least I can hold my own on water skis".

Celia Luterbacher is a journalist for swissinfo.ch

One woman, two passports, four degrees

Greek-born Eftychia 'Effy' Vayena, 44, earned her Bachelor's and Master's degrees in history and the history of science, technology, and medicine in Athens and London, before completing a PhD in the social history of medicine and bioethics at the University of Minnesota. Now a Swiss citizen, she completed a habilitation at the University of Zurich shortly before joining the Epidemiology, Biostatistics and Prevention Institute as an SNSF Assistant Professor of Health Policy in 2015.



Dangerous generalisations in medical research

No one wants to test new drugs on pregnant women or children. But they, too, need treatments that are effective and safe. Swiss researchers are now searching for ways to solve the problem. *By Alexandra Bröhm*

Drugs are taboo during pregnancy. That's the guiding principle. But the reality is different. According to an international study that was published in 2014 in the *British Medical Journal*, 80 percent of all women take drugs during pregnancy. So it's all the more important for medical personnel to know which substances could be dangerous to the unborn child, and which are safe. But pregnant women are often excluded from medical studies because no one is prepared to take a deliberate risk with the health of the foetus.

Although no one denies the fact that women and men are fundamentally different, medical researchers still generally test their new drugs and therapies on men. It's simply assumed that they will have the same impact on women. But that's by no means always the case.

“We don't want to subject sick children to experiments”

David Nadal

The metabolisms of men and women sometimes process drugs differently. The female liver contains certain other enzymes that can ensure that drugs work (or not). Furthermore, drugs are distributed differently in a woman's body. Women are mostly smaller than men, and have a higher proportion of fatty tissue. Certain drugs collect there, which again has an impact on their effectiveness. Then there's the female kidney, which only performs to 80 percent of the capacity of the male kidney. This fact naturally has an impact on how metabolites are excreted from the body. And this is all without taking women's menstrual cycle into consideration.

Reactions to the Thalidomide scandal

The situation with children is at least as difficult. Like women, they are barely taken into account in medical research. Researchers only develop very few drugs specifically for them. But when it comes to drugs and therapies, children are not merely small adults for whom one can simply reduce the dose according to their weight. And paediatric medicine covers a vast range of ages: you can't compare newborn babies with school-age children, any more than you can compare young people in puberty with toddlers.

Various initiatives have been set up in Switzerland that hope to change this untenable state of affairs. Alice Panchaud is a pharmacologist at the University Hospital in Lausanne (CHUV) and is investigating methods to help find non-hazardous

drugs for pregnant women. There was little awareness of this topic until the 1960s, when the Thalidomide scandal happened. Children were born with deformed arms and legs after their mothers took the sedative Thalidomide to help mitigate morning sickness during pregnancy. Since that scandal, everything has been done to try and keep pregnant women from taking any drugs at all. “Regrettably, that isn't realistic”, says Panchaud, who is currently on a two-year research visit to the Harvard School of Public Health. There are diseases that you simply have to treat during pregnancy because they would be more dangerous for the unborn child than any drugs used to treat them.

Collecting data on individual cases

Even if pregnant women don't take part in clinical trials, there are still two ways of getting usable data about them. Time and again there are cases of women taking drugs without being aware that they are pregnant. Then there are women who for medical reasons are compelled to take certain substances. “We urgently have to collect and analyse the data of these two groups”, says Panchaud. In this manner, a database could be constructed, listing drugs that are harmless to pregnant women. The rule of thumb is: wherever possible, no new drugs should be given to a pregnant woman, because we just don't know enough about them.

In the USA and northern Europe, good progress is being made on just such databases. In Switzerland, however, too little effort is being invested, and the situation is made more difficult by the far more modest amounts of data available. It's not just about determining whether a drug is harmless to pregnant women. The permissible dose can also often vary during pregnancy. Women gain weight and retain more water in their bodies, which mostly means that doctors have to increase their dosage. And for this, too, doctors ought to have the relevant data to help them make the right decision in individual cases. So at the CHUV in Lausanne, the relevant authorities are now setting up a biobank with blood samples of pregnant women who are being given drugs.

Children have different cancers

Efforts are also being made to improve the situation with children. The research network Swiss Pednet, which links the Swiss children's hospitals, is campaigning for the development of more drugs and therapies specifically for children. The dilemma is similar to that with pregnant women. No one wants to test drugs on healthy children, but at the same time there are many situations in which children need drugs. “We don't want to subject sick children to

experiments”, says David Nadal, Head of the Division of Infectious Diseases at the Zurich Children's Hospital and co-founder of Swiss Pednet. That is why a professional research structure is needed in paediatrics, along with the corresponding finances to enable researchers to collect and analyse data. “Society has to increase its awareness of just how important medical studies are in general, and especially for children”, says Nadal. Today, already more than 80 percent of children hospitalised with cancer are being treated within the framework of such studies. Especially in the case of cancer, there is a great need for new drugs that can specifically help children, because they usually fall sick from cancers that are different from those that affect adults.

Thanks to the initiative of various researchers, it has been proven in recent years that there is a clear gender difference in cases of heart disease. “Women die of heart attacks twice as often as men”, says Catherine Gebhard, a cardiologist at the Zurich University Hospital. And if they withstand an actual heart attack, they also have less chances of surviving afterwards. Nevertheless, only 24 percent of the test subjects in heart studies are female, and older women are barely represented at all, even though it has meanwhile become clear that male and female hearts develop differently in old age.

“Women die of heart attacks twice as often as men”

Catherine Gebhard

“We still know far too little about why women die more often than men after a heart attack”, says Gebhard. The problems begin already at the lowest level. Tests on lab animals are carried out in advance of clinical studies on humans, but almost all the lab animals used are male. The assumption is that the results will also be valid for female animals. Gebhard is now running a research project in which she hopes to find out why women's hearts age differently. In the near future, women with heart disease should be able to get targeted medical help just the same as pregnant women and children.

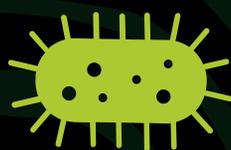
Alexandra Bröhm is a science journalist at the *Tages-Anzeiger* and the *Sonntagszeitung*.

Small insect, big trouble

Zika, dengue fever and malaria are all transmitted by mosquitoes. There are limits, however, to the use of pesticides to try and eradicate them. New research promises greater success.

Text: Florian Fisch

Infographics: Atelier CANA



MALARIA/DENGUE

Control through bacteria

Even mosquitoes can get ill. But bacteria that live in symbiosis with the mosquitoes can protect them from parasites. It is believed that *Spiroplasma* immunises mosquitoes against the malaria pathogen. If the mosquito does not become sick, it cannot pass on the pathogen. In this manner, humans would also be indirectly protected. Bacterial strains are now going to be collected in East Africa and tested on various mosquito species in the laboratory. If the interaction between bacteria and mosquito is understood, as is hoped, mosquitoes could be deliberately infected with it.

151932: Jeremy Herren, Centre of Insect Physiology and Ecology in Nairobi

Bacteria also protect mosquitoes from viruses. For example, *Wolbachia pipientis* bacteria have already been deployed against the dengue virus in tiger mosquitoes. It's not just the mobility of human beings that influences where specific viruses are found, but also these bacteria. It is hoped that genetic analyses of dengue viruses in Asia, Australia and in the rest of the world will help us to understand the spread of this disease. This will allow us to evaluate existing control measures and to develop new ones.

151594: Francesca Di Giallonardo, University of Sydney

MALARIA

Rapid recognition of infected mosquitoes

If you want to eradicate the malaria parasite, you need to be efficient. But laboratory infrastructure is absent in isolated malaria areas in particular, and there are insufficient numbers of entomologists. Today, an infrared detector can tell you the species and age of a mosquito within the space of a second. A new method should soon be able to determine whether the insect is infected with the malaria pathogen *Plasmodium*. Such a detector could analyse thousands of mosquitoes every day. This would allow us to record new outbreaks and the propagation paths of the disease in time for counter-measures to be undertaken.

164444: Maia Marta Ferreira, University of Basel



ZIKA

Identifying dangerous mosquito genes

Up to now, mosquitoes have been regarded as a homogeneous population. But they, too, are individuals, and not all of them are equally good carriers of disease. Research groups in Switzerland and Brazil are now collaborating to investigate the genetic diversity of mosquitoes. To this end, some 100 homozygous laboratory strains of the tiger mosquito *Aedes aegypti* are being bred and compared with each other. The strains will be examined to see how they differ in their longevity, fertility, flight capability, scenting capacity, diurnal rhythm, susceptibility to pathogens and resistance against insecticides. Gaining more knowledge about the lives of tiger mosquitoes should help us to combat them better.

164194: Bart Deplancke, EPFL

MALARIA

Refining a diagnosis

It is precisely our success in combating malaria that makes it even more difficult to eradicate the disease completely. More and more infected people only have a few parasites, or only display mild symptoms, or show none at all. New molecular tests will be able to determine whether infected people without symptoms can actually pass on the parasite. Rural healthcare centres in the Amazon Basin are especially poorly equipped to differentiate between the symptoms of malaria and the symptoms of other causes of fever. If new diagnostic possibilities are developed for this region, it could reduce unnecessary prescriptions of anti-malarial drugs and antibiotics.

164182 / 159580: Ingrid Felger, Swiss TPH, Basel

MALARIA

Tracing flight routes

Studying the efficacy of drugs is relatively simple. But if you want to find out whether insecticides, mosquito nets and traps really curb the spread of malaria, you need model calculations. In order to be better able to extrapolate the findings of local studies to cover larger regions, researchers are now investigating the flight routes of mosquitoes. In Bagamoyo (in Tanzania) and Rusinga Island (in Kenya), mosquitoes are marked with a colour when they hatch. This allows researchers to pinpoint the location of the insect's victims, and in which puddles the mosquitoes lay their eggs. These improved models will enable more efficient prevention measures to be taken.

163473: Sarah Moore, Swiss TPH, Basel

ZIKA

Continually updated overview

Is the Zika virus responsible for microcephaly among newborns? Can the virus be transmitted sexually? The World Health Organization (WHO) has to answer such questions repeatedly, and must constantly reassess the situation. It publishes all the proofs for and against such hypotheses in the form of systematic reviews. In order to make it easier to sort and summarise the information they get, a web-based platform is going to automate the literature searches, and bring their reviews up to date automatically. This will enable experts to reach a decision about causes and risks, almost in real time.

170069: Nicola Low, University of Bern

DENGUE FEVER

Immune systems against the virus

Everyone who is infected with dengue fever produces their own antibodies against the virus. Some of these antibodies are better than others at binding themselves to the pathogens. The antibodies of patients who have successfully overcome the disease are candidates for the development of vaccines and drugs. They can help us to understand what differentiates good antibodies from bad, and where the differences lie between different types of dengue fever.

138518: Luca Varani, Institute for Research in Biomedicine, Bellinzona

If antibodies don't neutralise a virus, then it enters human cells and releases its genetic material. This is then copied many times, packaged into new virus particles and released so that it can infect further cells and ultimately destroy them. Using specific marking molecules (RNA aptamers), researchers are looking into the processes within cells that help the virus to multiply. Our understanding of these processes could be a starting point to develop new drugs that might inhibit the reproduction of the viruses.

158788: Dominique Burri, Harvard Medical School

For information on these projects, enter the project number into the SNSF research database P3: <http://p3.snf.ch>

Being cruel to be kind?

Mathematical models of evolution can explain why cooperative behaviour is advantageous, and how living creatures can arm themselves against traitors. *By Stefan Stöcklin*

The theory of evolution supports egoistic behaviour, even down to the level of DNA as is reflected in the concept of the ‘selfish gene’. So it is astonishing just how often organisms actually cooperate. But without mutual assistance, nothing works. Male and female birds invest jointly in rearing their young, for example. Insects create veritable ‘States’ with tasks shared among them. The emergence of cooperative behaviour is a perennial topic of debate among biologists, and is a subject of intensive research by evolutionary biologists, geneticists and even game theorists.

Matthias Wubs is a doctoral student at the Department of Ecology and Evolution at the University of Neuchâtel, and his theoretical work is providing interesting, surprising insights into this topic. Together with Laurent Lehmann of the University of Lausanne and Redouan Bshary of the University of Neuchâtel, Wubs has been investigating conditions that favour cooperative behaviour in populations. The basis of their research is the famous prisoner’s dilemma: two suspects under arrest have a choice of working together and remaining silent, or of blowing the whistle on each other. Their chances are best if they cooperate with each other. If one of them spills the beans then he has the bigger advantage, but the other suspect is then put at a corresponding disadvantage. If they both reveal everything, then they will both receive a greater punishment than if they had stuck together and said nothing.

Three possible strategies

Taking this dilemma as his starting point, Wubs has been investigating a virtual population to see which of three strategies to promote cooperation would win through. An individual can either punish the traitor, leave him, or pay him back in the sense of ‘an eye for an eye’. Different parameters of the mathematical model can be varied for the different rounds of interaction – such as the size of the population and the actual number of interactions.

Although the model represents a simplification of real circumstances, it can depict biological principles realistically. In large groups, it is advantageous simply to avoid disloyal members. “The strategy of changing partner is the more dominant, the bigger the group and the bigger the number of interactions”, says Wubs. This result is intuitively comprehensible: in a large group,



Among white storks, if one partner cheats on the other, then the innocent party has to decide: are they to be punished or abandoned – or is it payback time? Photo: Marisa Estivill/Shutterstock

an individual that leaves its non-cooperating partner has a good chance of finding a better partner.

Group size is decisive

The ‘punishment’ alternative, however, requires lifelong effort to keep one’s partner in his place. This strategy changes with the population size and the number of interactions. “In small groups, it’s better to punish uncooperative members”, says Wubs. In the case of birds, this can mean that the renegade partner has a feather torn out. The individual carrying out the punishment thereby compels the partner to cooperate. In smaller groups this is advantageous, because the number of possible cooperating individuals is small.

“In small groups, it’s better to punish uncooperative members”

Matthias Wubs

Surprisingly, the computer simulations also showed that punishment was the means of choice in mid-size populations with some 50 interacting individuals. This wasn’t a result that Wubs had expected.

Simon Powers, a theoretical biologist and modeller who lectures at Napier University in Edinburgh, finds this result particularly worthy of emphasis: “Among biologists there has long been a debate about whether natural selection can favour the punishment of non-cooperating individuals”. In Powers’s opinion, the computer models developed by Wubs and his colleagues have now shown that punishment could even outweigh other forms of partner control.

Elegant maths can clearly help us to acquire new insights into evolution that would otherwise not be obvious. For Wubs as a theoretical biologist, the appeal of his specialist field lies precisely in this form of knowledge production. “We can develop hypotheses and test them”, he says. Empiricists can then look for real populations that the model predicts must exist.

Stefan Stöcklin is an editor in the Communication Department of the University of Zurich.

M. Wubs et al.: Coevolution between positive reciprocity, punishment, and partner switching in repeated interactions. Proceedings of the Royal Society of London B (2016)

Biscuits against lead poisoning

In Europe, petrol has been lead-free for 17 years now. For some countries in Asia and Africa, however, that is not (yet) the case. According to various estimates, between 25 and 75 percent of all pre-school children living in the urban areas of these countries have elevated levels of lead in their blood. These are alarming figures because lead has a neurotoxic effect and lowers IQ.

Lead poisoning often occurs in conjunction with an iron deficiency. Many researchers see this as not just a correlation, but a causal relationship. If the body lacks iron, it creates more proteins to promote iron absorption. But these proteins can also transport lead, because the two metals are chemically similar.

But does the reverse argument also apply? Can lead poisoning be avoided by improving iron intake? In order to answer this question, researchers under Michael Zimmermann at the Laboratory of Human Nutrition at ETH Zurich have been collaborating with specialists in environmental pollution from Morocco. Together, they carried out a clinical study of 457 children aged between 3 and 14 years old. For six months the children were given a biscuit that was either fortified with iron, or was a placebo.

And it was indeed demonstrated that the children with the iron-enriched biscuits had lower lead levels in their blood at the end of the study than before it. However, the additional iron had no impact on their cognitive abilities. "That is probably because lead causes irreversible damage to the developing brain", says Zimmermann. "This is why it is all the more important to take preventative action. We must fortify basic foodstuffs such as flour with iron, so that we can improve its intake among pregnant women and infants". *Ori Schipper*

R. R. Bouhouch et al.: Effects of wheat-flour biscuits fortified with iron and EDTA, alone and in combination, on blood lead concentration, iron status, and cognition in children: a double-blind randomized controlled trial. *The American Journal of Clinical Nutrition* (2016)



Yummy and healthy too. Children benefit doubly from iron-fortified biscuits.



Bleeding and muscular atrophy: the more drugs and doctors, the more side-effects.

Too many drugs

Roughly a third of the Swiss population suffers from several chronic illnesses at the same time – such as diabetes, kidney ailments or cardiovascular disorders. This is known as multimorbidity, and is primarily found among the elderly. Those affected often consume lots of drugs in parallel. But this has its drawbacks, says Carole Elodie Aubert of the Inselspital Bern: "Using many drugs simultaneously means they can interact and influence each other in their impact. Combining them can even bring about side-effects such as haemorrhaging or muscular atrophy".

Aubert and her colleagues carried out a study on the patient data of a thousand multimorbid people aged over 50 in the general outpatient departments of Swiss university hospitals. Using guidelines for treating older people, they then determined the quality of the treatment being given, taking into consideration all the drugs being administered. A third of them were taking five or more drugs at the same time. Within this heavily medicated group, the number of incorrect prescriptions was considerably higher than in the overall group: almost 10 percent compared with 3 percent, respectively. In other words, many drugs are being prescribed in a manner that isn't optimal.

Aubert believes there are several reasons for this. For example, multimorbid patients are often treated by different specialists who only take their own particular field into account. "And the general practitioner who ought to have an overview of all the drugs will hardly dare to question the instructions of the specialists", she says. "If there were better communication between the attending doctors, a lot of problems would already be solved". *Stéphane Praz*

C. E. Aubert et al.: Polypharmacy and specific comorbidities in university primary care settings. *European Journal of Internal Medicine* (2016)

Genetic cruise control

The human body can be compared to a highly complex machine whose fault-free functioning is made possible by inbuilt regulatory systems. For example, these systems keep our body temperature at a roughly constant 37 degrees Celsius, regardless of whether we are sitting on a chair in a cold room or playing tennis in a heated indoor hall.

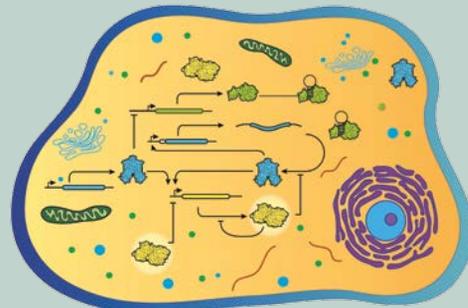
"The problem is that these regulatory systems can crash", says Mustafa Khammash, Head of the Control Theory and Systems Biology Lab at ETH Zurich. The results of this can be illness – which in a worst-case scenario means cancer. "That's why we have been trying to insert such regulatory systems artificially into human cells. We hope to use them to replace the corrupted regulatory controls".

Khammash and his team have been inspired by electrical engineering, where so-called proportional-integral-derivative feedback controllers are employed. These are circuits that continuously compare a specific desired value with a setpoint and then make the necessary corrections. "They are used in cruise control devices in cars, for example", says Khammash.

In order to insert such a control circuit into a cell, the cell has to be subjected to genetic alterations. They modify its genetic material so skilfully that it creates a precisely determined series of three new proteins that then interact with each other to form a new regulatory circuit. Khammash and his team have succeeded in doing this in human kidney cells.

The next step is to plant such programmed cells into a model organism. This would mean that Khammash and his team could monitor different blood values and, if necessary, produce molecules to keep the blood values in the normal range. Just like cruise control. *Atlant Bieri*

C. Briat et al.: Design of a Synthetic Integral Feedback Circuit: Dynamic Analysis and DNA Implementation. *ACS Synthetic Biology* (2016)



Defective cells can be repaired with artificial control circuits.

Where the greenhouse gases go

The oceans, forests and soils store carbon dioxide and thereby help to slow down global warming. Researchers would like to find out whether we can continue to rely on their help in the future. *By Sven Titz*

Almost half of the carbon dioxide that humans release into the environment is taken up by the world's oceans and the terrestrial biosphere. In this manner, greenhouse gases are partially extracted from the atmosphere, which alleviates the process of global warming. But will the land and the seas be able to continue storing carbon dioxide in the future? Researchers aren't sure. Changes in ocean circulation, woodland clearances and stress reactions in forests could reduce their capacity to act as carbon sinks.

On land, plants and trees take up carbon dioxide (CO₂) through photosynthesis. Carbon later returns to the soil in the form of plant matter, which is why large quantities of it are stored there. When the climate heats up, however, the soils can emit this stored carbon again by means of microbial decomposition. Researchers are trying to find out which process will gain the upper hand in future - and Switzerland is one of the sites for their analyses.

Tree-line topsoil

How much carbon lies in the ground, and how might this change? Frank Hagedorn is based at the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) in Birmensdorf, and he's been engaged in numerous projects to find out the answers. It's the topsoil that's decisive, because it contains carbon that can be broken down especially easily. In one of their projects, Hagedorn's team was able to demonstrate that this degradation process is particularly relevant in the areas around the tree line. They flushed an ecosystem with CO₂ at the tree line above Davos, marking it with special carbon isotopes so that they could trace how the materials cycles changed. The soils of alpine ecosystems are particularly rich in carbon, and it transpired

that they can emit a correspondingly large amount of CO₂ when the temperature rises. This process has already begun on account of man-made climate change.

In order to be able to draw conclusions about CO₂ sinks on a European or worldwide scale, researchers need standardised measurements. These can then be extrapolated for larger geographical areas, using computer models. In the European consortium project 'ICOS Research Infrastructure', measurement instruments and data processing are currently being standardised. The project began officially in 2015 and Nina Buchmann of ETH Zurich is coordinating the Swiss end of it ('ICOS-CH'). Two measurement locations are participating here in Switzerland, she says: one in a spruce forest, also near Davos, and one at the Jungfrauoch research station.

Unreliable forests

Many years of measurements have already proven that forests absorb a lot of CO₂. In the forests outside Davos, CO₂ flows were actually measured as far back as 1997, though other instruments were used back then, says Buchmann. "The ecosystem has been a CO₂ sink the whole time", she says. The same is not true of every forest in Switzerland, however. Replanted areas, for example, can be a source of CO₂ at the beginning, because the soil there loses a lot of carbon. This only changes when the trees are bigger and the forest has become established, at which point it becomes a CO₂ sink. The older the forest, however, the less carbon is found in the soil, and the more is found in the wood and leaves of the trees. That was proven by National Research Programme 68 'Sustainable use of soil as a resource' (NRP 68).

But will the forests also store CO₂ in the future? Buchmann sees two fundamental factors of uncertainty: climate change

and forest exploitation. A forest's storage function can be impaired by droughts, by changes in the way it is used, and by changes in the area it covers.

"A forest outside Davos has been a CO₂ sink since 1997"

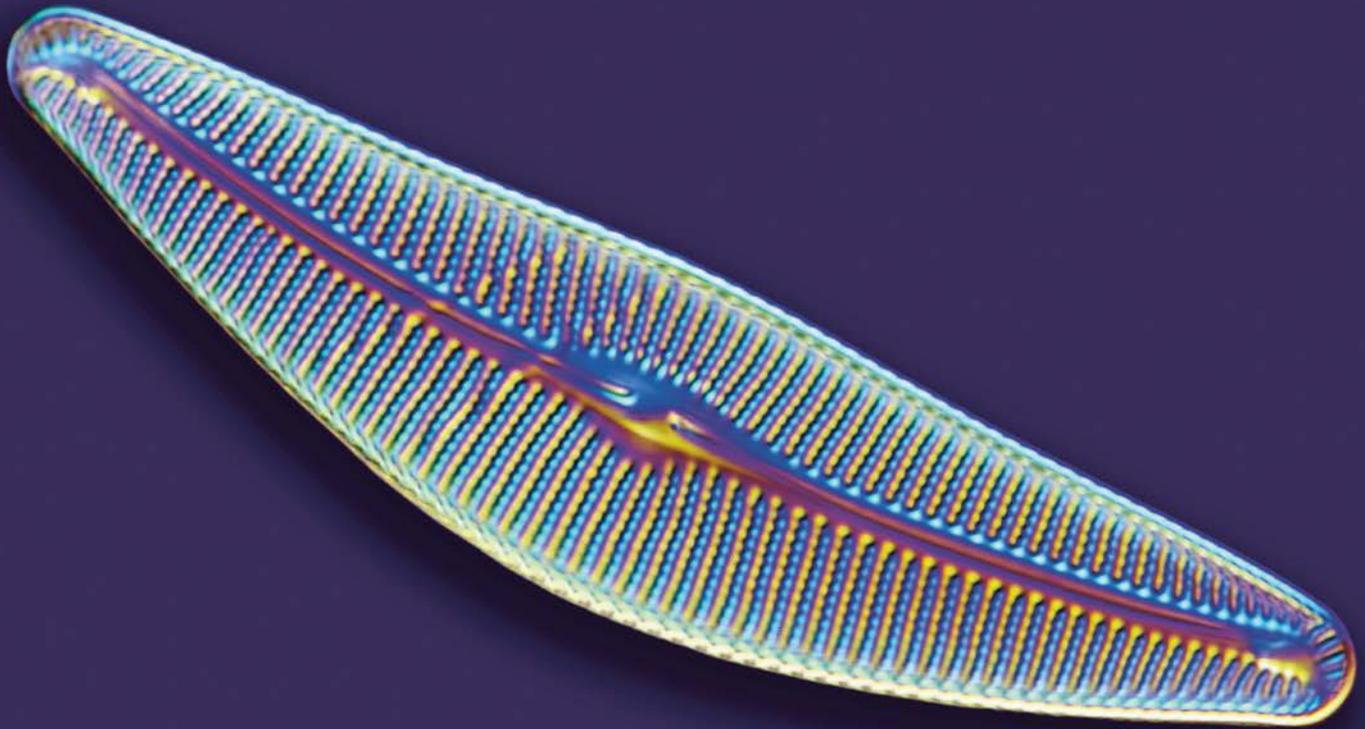
Nina Buchmann

Nevertheless, forests are neither the only source of uncertainty, nor the biggest such factor. Many researchers, including those at Agroscope (the Swiss Federal Centre of Excellence for agricultural research), are concerned about the reduction of the topsoil on account of agricultural usage. In global terms, however, the most sensitive land areas with natural carbon sinks are in the far North. Methane is an especially potent greenhouse gas that is emitted by the permafrost soil as it warms up. According to Hagedorn, the amount emitted depends primarily on whether the soil warms up under humid or dry conditions. The higher the humidity, the greater the amount of methane that is released; when conditions are drier, more CO₂ is emitted.

Expedition to the Antarctic Ocean

The oceans also absorb huge amounts of CO₂. At present, the most important marine sink for CO₂ is the Southern Ocean that stretches around Antarctica. In December 2016, the Swiss Polar Institute (coordinated by EPFL) set out on a research voyage in the Southern Ocean as part of the international Antarctic Circumnavigation Expedition (ACE).

One of the expedition's projects is devoted to studying phytoplankton, because its photosynthesis plays a significant role in the CO₂ absorption capacity of the South-



The characteristic shells of these algae offer clues about wind conditions thousands of years ago. Photo: Keystone/Science Photo Library/Frank Fox

ern Ocean. When these algae die, they sink to the bottom of the ocean, taking carbon with them. Samuel Jaccard from the Oeschger Centre for Climate Change Research at the University of Bern is one of the participating researchers. During the expedition, the team want to retrieve seawater samples from different depths down to 1,500 metres. They'll bring these samples to the surface in bottles and then subject them to geochemical tests in the lab. The data they hope to gain should explain how carbon is delivered to the ocean depths, and how quickly this occurs.

“When the conditions are more humid, permafrost soils release more methane”

Frank Hagedorn

The amount of CO₂ absorbed by the Southern Ocean also depends on the wind that drives the ocean currents. Cold water is good at storing CO₂, but in the past, cold, deep water that is rich in CO₂ has been driven to the surface by specific wind

conditions - and it is at the surface where temperatures are warmer. As a result, the Southern Ocean released CO₂ into the atmosphere. But we hardly know anything about the natural fluctuations of wind movements. In order to determine when the Southern Ocean has absorbed and released CO₂ in the past, a further ACE project is endeavouring to reconstruct past wind movements. The director of the Oeschger Centre, Martin Grosjean, is participating in this project.

The way the wind blew

During their research voyage, Grosjean's project partners will be drilling on several sub-Antarctic islands to collect sediments from lakes. These will subsequently be analysed in the lab by Grosjean and others. Algae that used to live in these lakes are today found fossilised in this sediment, and they can provide us with information on wind intensity during the Holocene period.

Reconstructing these winds means drawing complex conclusions from the data. The salt content of the island lakes is influenced by the wind intensity, for example. Strong winds drive more spray into the air and more salt into the lakes than do

lighter winds. This has an impact on the algae, as Grosjean explains: “Algae vary in their sensitivity to salt”. So the species composition of the algae in the sediments can allow the researchers to determine the former salt content of the lake, and thus also the strength of the winds at the time.

In recent years, says Grosjean, the wind has become more intense around the Antarctic. No one yet knows why this has happened. It could be a result of the hole in the ozone layer, or it could be connected to global warming. So it is also difficult to make any prognosis about how much CO₂ the Southern Ocean will be able to store in future.

All the same, several studies have already demonstrated that a little more CO₂ has been absorbed in recent years than was earlier the case. The same is true of the land biosphere. But we cannot rely on this trend continuing. In order to estimate the danger of CO₂ absorption coming to an end, the materials cycles have to be investigated more precisely - both on land and in the seas.

Sven Titz is a freelance science journalist.

Low-cost space flight

Nanosatellites weigh just over a kilogram, don't cost more than a family car, and are destined to democratise access to space. Researchers and manufacturers from Switzerland are involved.

By Roland Fischer

The space flight scene is in a state of upheaval. Something along the lines of a democratisation of space is happening - at least as far as the lower orbits are concerned. For several years, numerous universities have been experimenting with so-called nanosatellites. In the coming years, they will probably experience a commercial breakthrough - and Switzerland is playing an important role in it.

For example, there are young entrepreneurs such as the Astrocast team from Lausanne who want to use nanosatellites to create a global data network for the Internet of Things. With a planned minimum bandwidth of one kilobyte per day, the technology is correspondingly cheap. Initial commercial deals have been agreed, and they are presently looking for a partner who can offer low-cost transport. In fact, constructing small satellites is now such a routine matter that it's more expensive to put a satellite into orbit than to make it.

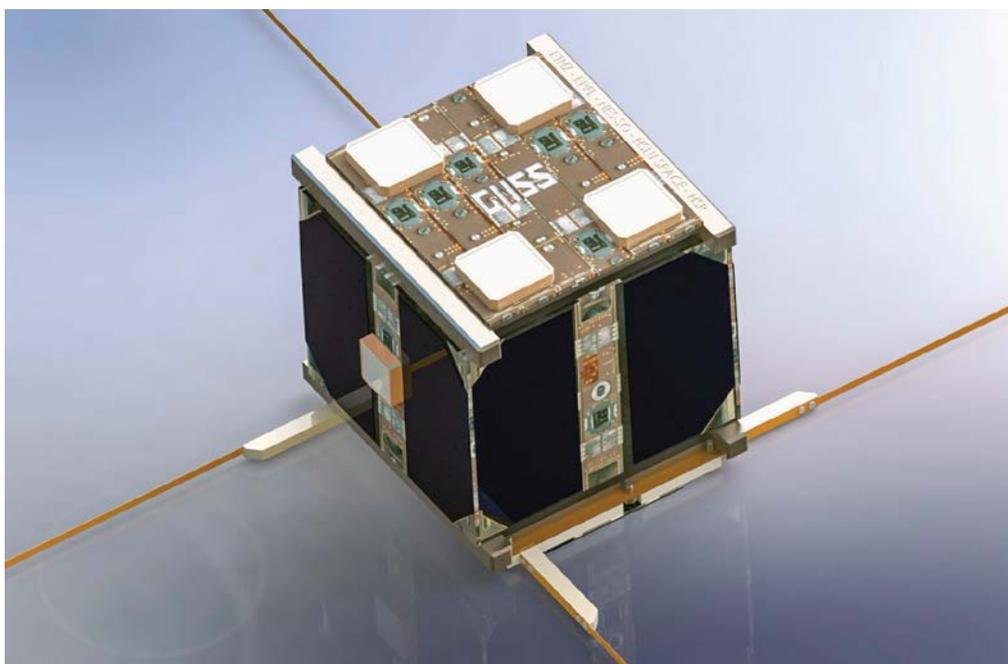
“Today, every university can produce its own satellites”

Markus Rothacher

‘Low cost’ - that's the magic word in this ‘new space movement’. “Until now, space missions were the preserve of the big state agencies”, says Markus Rothacher, a professor of mathematics and physical geodesy at ETH Zurich. “But today, every university is in a position to produce its own satellites, as are the smaller companies”.

Independent GPS

The EPFL spin-off company Astrocast is basing what it does on the expertise gained from the Swisscube, which was the first and so far the only small satellite to have been launched by a Swiss university, back



The CubETH satellite is a four-inch cube and is intended to be an alternative to the GPS system of the USA. Photo: Reto Wiesendanger, EPFL

in 2009. A successor satellite should have long been sent up, but the CubETH project of ETH Zurich and EPFL isn't quite getting off the ground. They planned building a four-inch cube with which to be able to test a simple global navigation satellite system independent of the American GPS. It's not a receiver designed especially for space, but is made using off-the-rack technology. The researchers at ETH Zurich are currently examining whether the GNSS chips mass-produced by the Thalwil company U-Blox are suitable for the inhospitable conditions of space. They have already survived the vacuum chamber of Ruag Space without incurring any damage, and they are currently undergoing radiation tests at the Paul Scherrer Institute.

The technology of CubETH is of central interest to the Astrocast mission, and the chip will be tested in 2017 on one of the first flights of the Lausanne spin-off. Astrocast will send a total of 64 small satellites into low orbit in the coming years in order to achieve unbroken coverage of the whole Earth's surface. “The primary goal is to win over commercial operators such as transport companies and the manufacturers of measurement systems”, says CEO Fabien Jordan. But he hopes that researchers from a multitude of disciplines, from meteorology to biology, will be among those using his infrastructure. For example, researchers might want to collect extensive data auto-

matically from deserts or icy regions. With further sensors, many other applications can be opened up, such as tsunami warning systems.

Internet from space

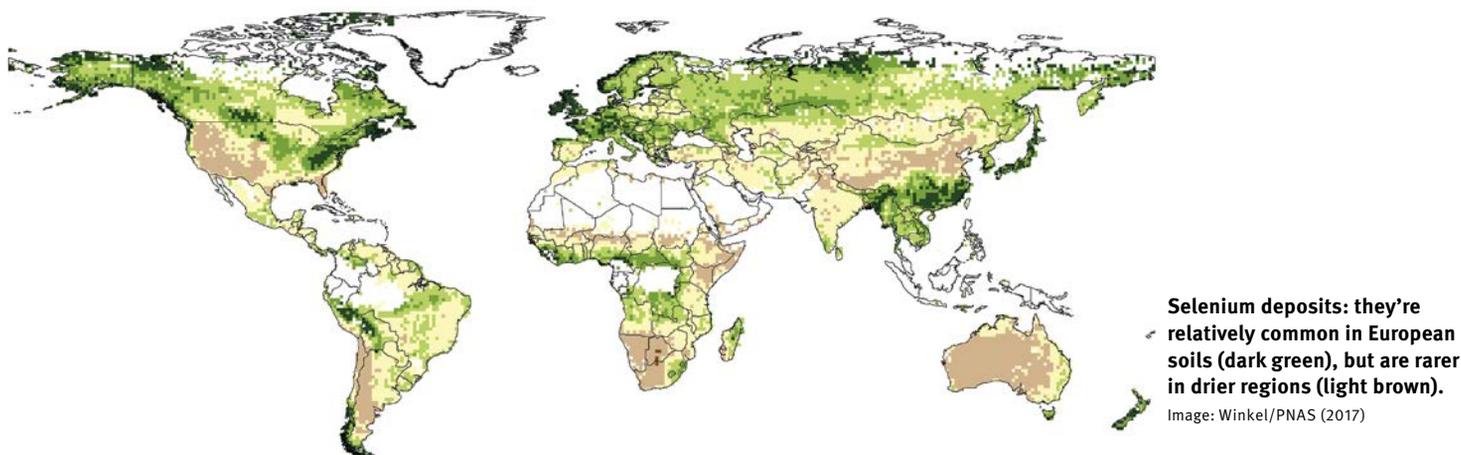
Michael Swartwout from the University St. Louis is documenting the development of nanosatellites in an online database. He doesn't see any sign of an imminent drop in the rapid growth that began in 2014. “No slowdown in sight, not at all”, he says. People estimate that by the year 2020 there will be thousands of small satellites in orbit, most of them for telecommunications. By that same year, the company Oneweb wants to have a constellation of 648 satellites in orbit so as to provide Internet access all over the Earth. Elon Musk, the founder of Tesla, is pursuing a similar goal. In November, Oneweb announced who is going to make their satellites: Ruag in Switzerland. It's a prestigious deal, though hardly one to bring in billions - after all, it's ‘low cost’. In Switzerland, the 600-plus satellites will be built for just CHF 20 million. That's CHF 33,000 each: the price of a medium-sized car.

Roland Fischer is a freelance science journalist in Bern.

The world map of a trace element

Selenium is important to all living creatures. A unique project is mapping the worldwide distribution of this trace element and is trying to find the reasons for the lack of it.

By *Alexandra Bröhm*



The trace element selenium (Se) only occurs in tiny concentrations and yet is essential to living beings. It usually gets less attention than its big brothers iron, iodine or zinc, but neither human beings nor animals can do without it. This was reason enough for the biogeochemist Lenny Winkel from the Department of Environmental Sciences at ETH Zurich and Eawag to devote herself more intensively to this trace element. And Winkel isn't just looking at it on a molecular level, but as part of a bigger picture. Together with her team, she's investigating what the distribution of selenium looks like across the globe, and what factors determine where it occurs.

Worldwide deficiency

"Basically, we don't know so much about the distribution of trace elements", says Winkel. The concentration of selenium in the soil is different from one region to the next. Humans absorb selenium primarily through plant-based foodstuffs. But even in plants, the selenium content varies greatly according to where they grow.

There are estimates that between half a million and a million people across the world suffer from selenium deficiency. In Europe - and thus in Switzerland too - the problem is not so much the concentration of selenium in the soil, but the amount of it that's absorbed by plants, says Winkel. But this does not mean that everyone in Switzerland is necessarily suffering from a selenium deficiency, because we rarely subsist on purely local products.

Mongolia's selenium chickens

"The concentration of selenium in the earth is also decreasing everywhere on account of global warming", says Winkel. She and her team have recently published the first-ever global map of selenium distribution in the soil. It's not just Europe that's affected, but other areas on other continents too. In Mongolia, the authorities began a programme in 2016 to give chickens feed that has been enriched with selenium. The eggs produced by these chickens could help to reduce the deficiency symptoms among the population.

Humans absorb selenium primarily through plant-based foodstuffs.

Different climate and soil parameters determine how much selenium is concentrated in the soil. As a rule of thumb: if the soil is dry, the selenium content is usually too low. But it's not just the amount of rainfall that determines the concentration of it. The condition of the soil plays an important role, as does the amount of organic carbon in it. This organic material binds with the selenium and keeps it longer in the soil.

"Lenny Winkel's research project is very important - and it's unique", says Markus Lenz of FHNW School of Life Sciences, who is also researching into selenium. There are few comparable projects that deal with the global distribution of trace elements.

Nor is selenium easy to investigate, because it has a highly complex chemistry and occurs in the environment in different bonding forms.

It is also still unclear to what extent the phytoplankton in the oceans play a role in the global distribution of this trace element. This is something that Winkel's team wants to investigate further. Only if we know more about the global distribution channels of selenium can we hope to take measures to combat its deficiency in specific areas - a deficiency that climate change is only making worse.

Alexandra Bröhm is a science journalist at the Tages-Anzeiger and the Sonntagszeitung.

G.D. Jones et al.: Selenium deficiency risk predicted to increase under future climate change. PNAS (2017)

A building block of amino acids

Selenium is important to human beings because it is part of an amino acid. This trace element helps to prevent cell damage. It also plays an important role in the immune system and participates in the production of the thyroid hormone. The ideal dose of selenium for human beings is relatively small: between 40 and 400 micrograms per day. Below 30 micrograms is regarded as a selenium deficiency, while doses of over 900 micrograms are toxic.

An algorithm to decipher Mayan glyphs

Only three Mayan books have survived both the Spanish conquest and the ravages of time. These very badly damaged cork manuscripts were penned during the period 1000 to 1519. Because of their poor state, it's not possible to index them in a database, where they would otherwise be analysed automatically. This may change, however, thanks to an extraction process that has been honed by researchers at the Idiap Research Institute in Martigny in the canton of Valais.

"The cork that the Mayans used for their writing is often stained, the ink often degraded and the glyphs of different sizes", say Rai Hu, a researcher at Idiap. "This is why standard binarisation can't make them out properly". So, the researchers adapted a system used to segment images into regions, and created a new algorithm that captures each separate image using superpixels at a range of resolutions. This enables the differentiation of the glyphs in the images.

In 2015, Hu and her team created a database containing several hundred Mayan glyphs. "But for the database to be compiled initially, specialists in Mayan writing had to extract the glyphs from the books by hand", says Hu. "This was a mammoth task that took around 30 minutes per glyph, depending on the complexity and state of each individual one". The new automatic extraction algorithm will now save the experts time. By combining the functions of automated visual searches, it will allow rapid access to this large index of characters. Not only might this help us to understand these ancient texts more thoroughly, but it could also aid us in identifying the 10 percent of the glyphs that we still can't decipher. *Geneviève Ruiz*

R. Hu et al.: Extracting Maya glyphs from degraded ancient documents via image segmentation. ACM Journal on Computing and Cultural Heritage (unpublished)

Mayan hieroglyphs from the Dresden Codex, manually processed by Carlos Pallán Gayol, based on the 1880 facsimile by Ernst Förstemann.



Mayan glyphs from the Dresden Codex (left column) being digitally restored (in blue).



Super-massive black holes are created when galaxies merge.

Offspring of galaxies

They are the heaviest objects in the Universe: supermassive black holes weighing more than a billion Suns. Hundreds of thousands of them have been observed so far, always at the centres of galaxies. Their formation in the early days of the Universe, around one billion years after the Big Bang, is still poorly understood, however.

According to one new study, their extremely rapid growth probably results from the merging of galaxies. An international team found evidence of galaxy mergers in three of the six supermassive black holes they observed. "It sounds like little evidence, but it's an important discovery", says the main author of the study, Benny Trakhtenbrot of ETH Zurich. "Most normal galaxies stand on their own, so to find here that 50 percent resulted from mergers indicates that it might indeed be the main mechanism for the formation of supermassive black holes."

"Most galaxies have more than enough mass to feed a black hole," explains the astronomer, "but the gases they attract have first to lose their angular momentum by circling around the black hole, like water around the bathtub drain. The close presence of a galaxy changes the gravitational force felt by the gas, a bit like the Moon creates tides on Earth. This helps the gas to move rapidly and directly towards the centre of the galaxy where the black hole lies."

Although not even light can escape their gravitational force, astronomers can observe black holes indirectly, as the gases reach such velocities that they emit extremely powerful electromagnetic radiation - up to a hundred times the total luminosity of the Milky Way. In this case, the team used the ALMA facility in Chile, an array of dozens of antennas situated at an altitude of 5,000 metres, whose power allowed for the detection of the neighbouring galaxies. The incoming light had been travelling for more than 12 billion years. *dsa*

B. Trakhtenbrot et al.: ALMA Observations Show Major Mergers Among the Host Galaxies of Fast-growing, High-redshift Supermassive Black Holes. *The Astrophysical Journal*, (2017)

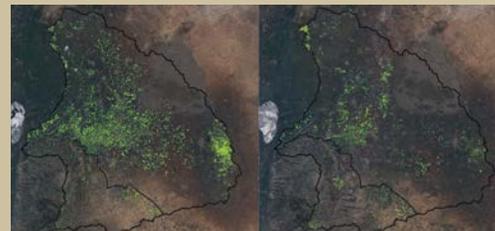
Syria's war is redistributing the region's water

According to a study by researchers in the US and Canada, Syria's irrigated areas and water reservoirs behind dams have been depleted by half since 2013, the year that marked the beginning of the migratory crisis whose roots lie in the war. The war and the popular exodus have had a significant impact on the region's water resources. Because less water is being used in Syria, the flow rate of the Yarmuk, a river that the country shares with Israel and Jordan, has actually increased in Jordan.

The researchers used NASA satellite images to measure the drop in irrigation and reservoir levels by comparing them over time. This was the only method open to them, given that ground work is impossible in Syria. This means that the exact causes of their findings are not yet clear. "We do not know, for example, whether the level of reservoirs has fallen because there is less demand or because they've been abandoned", says the main author and Swiss national Marc Müller, an assistant professor at the University of Notre Dame in Indiana.

This is the first study to examine the effects of the war on water with any accuracy. "The impact of water on conflicts has been dealt with very thoroughly, but not the opposite", says Müller. The researcher warns that it would be wrong to think that Jordan is profiting from the neighbouring war. It has received hundreds of thousands of Syrian refugees and not even the increased level of the Yarmuk can help it meet the needs of these people. *Benjamin Keller*

M. F. Müller et al.: Impact of the Syrian refugee crisis on land use and transboundary freshwater resources. *PNAS* (2016)



In Syria, water utilisation went down by 50 percent between 2012 (left) and 2015.

Data: Landsat 7

An anti-paralysis button

A start-up in Lausanne hopes to improve the re-education of paralysed limbs. The idea is to give patients greater control over therapy.

Text: Daniel Saraga

Infographic: Ikonaut

1 Strokes and paralysis

A stroke deprives areas of the brain of oxygen and can lead to paralysed limbs. Where paralysis is comprehensive, the patient can only move with external help.

2 Stimulating muscles

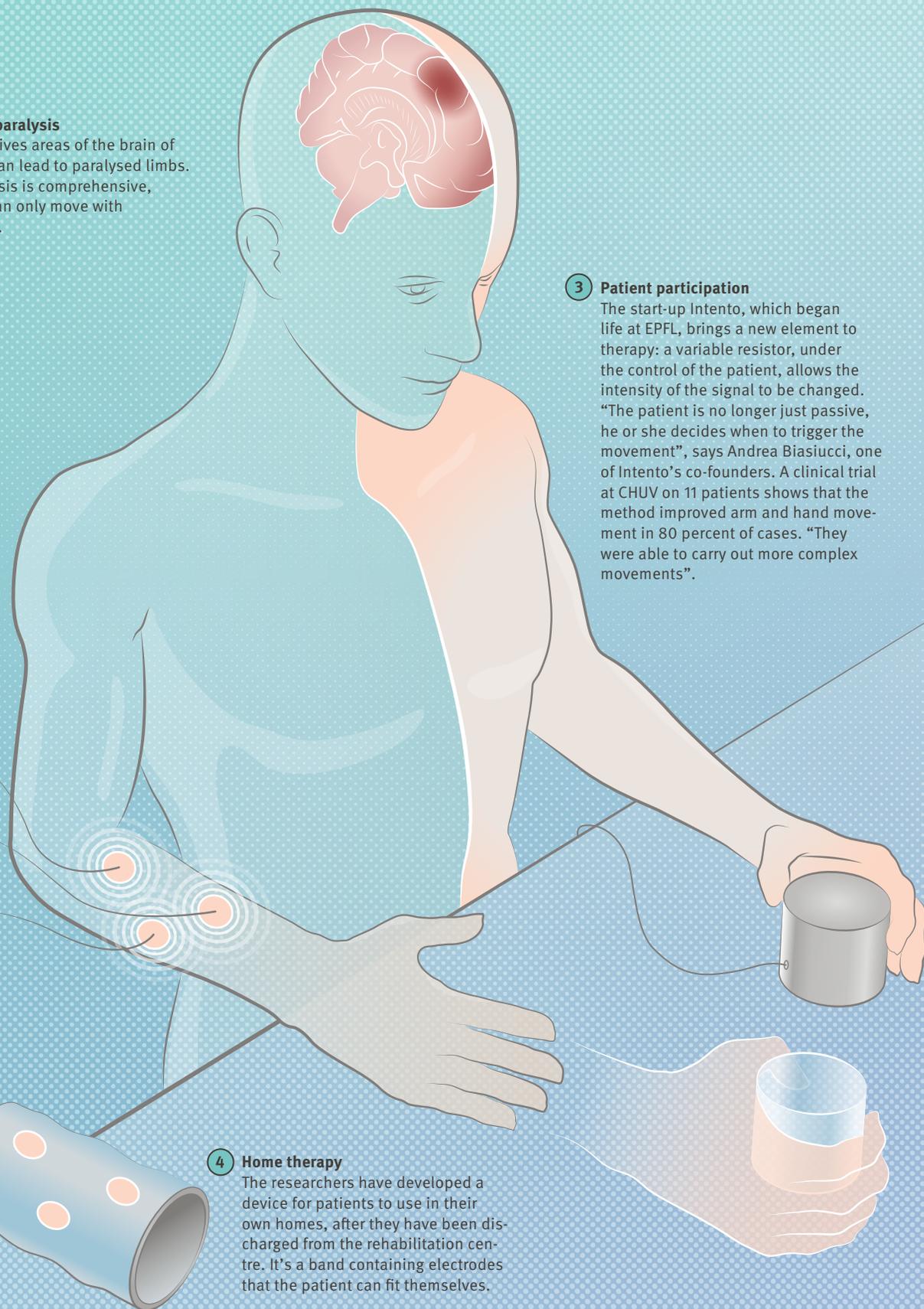
Using functional electric stimulation, a series of low-intensity shocks is sent through the part of the nervous system controlling the muscles. The result is that the muscles move in a certain way, which allows the patient to complete physiotherapy exercises. In severe cases, however, the efficacy of this method is not yet established.

3 Patient participation

The start-up Intento, which began life at EPFL, brings a new element to therapy: a variable resistor, under the control of the patient, allows the intensity of the signal to be changed. "The patient is no longer just passive, he or she decides when to trigger the movement", says Andrea Biasiucci, one of Intento's co-founders. A clinical trial at CHUV on 11 patients shows that the method improved arm and hand movement in 80 percent of cases. "They were able to carry out more complex movements".

4 Home therapy

The researchers have developed a device for patients to use in their own homes, after they have been discharged from the rehabilitation centre. It's a band containing electrodes that the patient can fit themselves.



The genetic material of Swiss innovation

By Maurice Campagna

'Deoxyribonucleic acid' is twenty letters describing a discovery as simple as it is complex. Living things write their code in their genetic material with only four nucleobases: adenine (A), thymine (T), guanine (G) and cytosine (C). We all know the abbreviation stemming from this discovery: DNA. Just as we all know how it's depicted geometrically: as a double helix. The origins of the discovery lie



Valérie Chérelat

in the 1860s, when the Swiss doctor Friedrich Miescher discovered a substance that he found in an extract of pus. He called it 'nuclein'. It was only after innumerable experiments by many researchers that James Watson, Francis Crick and Maurice Wilkins were awarded the Nobel Prize for Medicine in 1962 for decoding the

molecular structure of the nucleic acids and for determining their significance in transmitting information in living things. ATGC - no more and no less.

The model of the double helix might have inspired biochemists to begin describing processes in living creatures, but it also did a lot more besides. Two natural scientists showed not so long ago that the double helix can be used to store data - from books and photos to films and music. Architects use the spiral of the gene as a reference point when designing skyscrapers. And hair stylists braid long hair into pigtales with double plaits.

The secret to innovation and successful entrepreneurship is also founded on four basic elements: decentralisation,

openness, continuity and autonomy - DOCA. Switzerland is an ideal place to build on these four basic pillars. Healthy competition between scientists is vital in a small country where the creativity of decentralised locations is part and parcel of the greater, overall network, and if we wish innovation to emerge from the bottom up. In our discussions about participating in European research programmes such as Horizon 2020, we have seen the great value of an open exchange of ideas, both within Switzerland and beyond its borders. And continuity in the overall environment serves to promote the successful progress of research projects. What will we do if the creativity of our researchers is curtailed by the emergence of constricting dependencies? If individual responsibility - autonomy - is lost?

DOCA explains in simple fashion how, through open competition, the philosophy 'think global, act local' can function in a country of different cultures such as Switzerland. Common values, common goals and the simplest possible steering mechanisms for decentralised implementation: this is how we can efficiently apply the resources at our disposal - as long as openness, continuity and autonomy are all guaranteed.

Maurice Campagna is the President of the Swiss Academies of Arts and Science.

6 March 2017

Travelling to Mars via Lucerne

The renovated planetarium is being opened in the Swiss Museum of Transport. In a new section, images from numerous missions to Mars can be seen.

[Swiss Museum of Transport, Lucerne](#)

16/17 March 2017

Media in a direct democracy

The central role of the media in democratic processes is the topic of the 9th Aarau Democracy Days.

[Kultur und Kongresshaus, Aarau](#)

11 April 2017

Swiss Global Change Day

For the 18th time, climate researchers from different disciplines will meet together to discuss their latest findings.

[Freies Gymnasium, Bern](#)

until 30 April 2017

Mummies: Mysteries of time

This exhibition explores the various aspects of the phenomena that enable dead bodies to be preserved.

[Naturhistorisches Museum, Basel](#)

10 to 13 May 2017

Biology, inventions and citizen science

BioFabbing is open to enthusiasts, practitioners and researchers in the field of biohacking and do-it-yourself biology. The goal of this convergence is to exchange information and to learn together.

[tbc, Geneva](#)

Until 1 June 2017

500 years after Luther's Theses

The series of events at the University of Zurich entitled '500 years of the Reformation' will investigate its impact, both past and future.

[University of Zurich](#)

Letters to the editor

Nothing new

I'm writing in response to your editorial (Horizons 111, p. 2), which, in the French version, was very well translated. I graduated with Master's degrees in tropical medicine and in public health (1994) and have worked professionally in Sub-Saharan Africa (for four years between 1979 and 1985 - probably a long time ago in your eyes), and I see nothing new in what you say. We know about the need to work with local researchers, and to carry out cost effectiveness analyses. Nothing you say is wrong; I just expected something more.

Dr Virgile Woringe, Lausanne (Mail, 4.12.16)

The stony path to greater knowledge

The portrait of ambitious impact assessment in international cooperation (Horizons 111, p. 12), while incisive in itself, is nevertheless disappointing for four reasons. First, there are matters of balance: despite emphasising the large federal contributions to international cooperation, no one close to the Swiss Agency for Development and Cooperation (SDE) is given a chance to speak. The German Institute for Development Evaluation (DEval) and the Center for Development and Cooperation (NADEL) at ETH Zurich explain scientific, methodological issues, but are less practically oriented. Secondly, there is the methodological debate: subsidised organisations can hardly afford expensive impact analyses with

control groups. Furthermore, it is rare to find comparative examples where there are no interventions. This is why their prime concern is with mixed methods, in order to use modest means to achieve the best possible knowledge gains. Thirdly, independence: both DEval and NADEL receive public funds and are thus hardly more independent than internal evaluation departments. Lastly, the core message: thanks to the pressure of accountability, development policy has attained high standards and finely balanced systems of impact measurement such as we hardly find in any other branch of policy.

Martin Sommer, independent consultant in international cooperation, formerly Head of Evaluation at SDE (2012 - 2014)

A networker as new President of the SAMS

FotoGraf & Graf GmbH



Daniel Scheidegger is the new President of the Swiss Academy of Medical Sciences (SAMS). He is taking over from Peter Meier-Abt, who was appointed President in 2011. Scheidegger's participation in national committees

and institutions means he is already embedded into an extensive network in the health sector. He was a department head at the Basel Cantonal Hospital and Chair of Anaesthesiology and Reanimation at the University of Basel.

SNSF is supporting 42 women researchers

The SNSF has awarded the very last Marie Heim-Vögtlin (MHV) grants to highly qualified women researchers who have had to interrupt or reduce their scientific activities due to family commitments. Out of 147 applicants, 42 women researchers from 12 Swiss universities and research institutes were chosen. Postdoctoral researchers received 83 percent of the grants, and doctoral students 17 percent, totalling 8.7 million Swiss francs in allocations. MHV grants will no longer be awarded. In autumn 2017, the funding instrument 'Prima' (Promoting Women in Academia) will be introduced for excellent women researchers at postdoc level.

New study proposes pragmatic open-access scenario

For the first-ever time, scenarios have been developed for remodelling the scientific publication scene in Switzerland so as to achieve open access. The study in question has analysed financial flows and recommends a pragmatic, flexible scenario in order to make publicly funded research freely and immediately available in future, at no cost. The financial flow analysis was launched by the SNSF together with the programme 'Scientific access' (SUK P-2) by swissuniversities. Potential scenarios for restructuring the scientific publishing system in Switzerland are being discussed as part of the national strategy and the open-access action plan.

Nine new members of the SNSF Research Council

The Executive Committee of the SNSF Foundation Council has elected nine new research councillors. Olivier Schneider (EPFL), Aude Billard (EPFL), Joachim Buhmann (ETH Zurich) and Karl Gademann (University of Zurich) were elected for the Mathematics, Natural and Engineering Sciences division; Anastasia Ailamaki (EPFL), Jan Carmeliet (ETH Zurich), Andreas Mayer (University of Lausanne), Nicolas Rodondi (University of Bern) and Uschi Backes-Gellner (University of Zurich) were elected for the Programmes division.

Media training and writing workshops for researchers

Media work has its own rules. At the SNSF's media training and writing workshops, interested parties can acquire expertise in engaging with a broader public. These SNSF media courses began in 2008 and are aimed at researchers who already have initial experience of research at postdoc level. Reduced course fees are available to researchers who are supported by either the SNSF or its partners, the Commission for Technology and Innovation (CTI), or the Mercator Suisse or Gebert RUF foundations. The dates of the courses are given on the SNSF website.

Prix Expo for the Valais Nature Museum



Musées cantonaux du Valais, Sion
Robert Hofer

The Swiss Academy of Sciences (SCNAT) has awarded the Prix Expo 2016 to the Valais Nature Museum for its exhibition: 'Objective Earth: Living in the Anthropocene'. The jury was impressed by how the Museum dealt with a highly controversial topic, yet without any sensationalism. The jury was also enthusiastic about its multidisciplinary approach and the outstanding art of presentation. The exhibition runs until 2 April 2017.

Horizons

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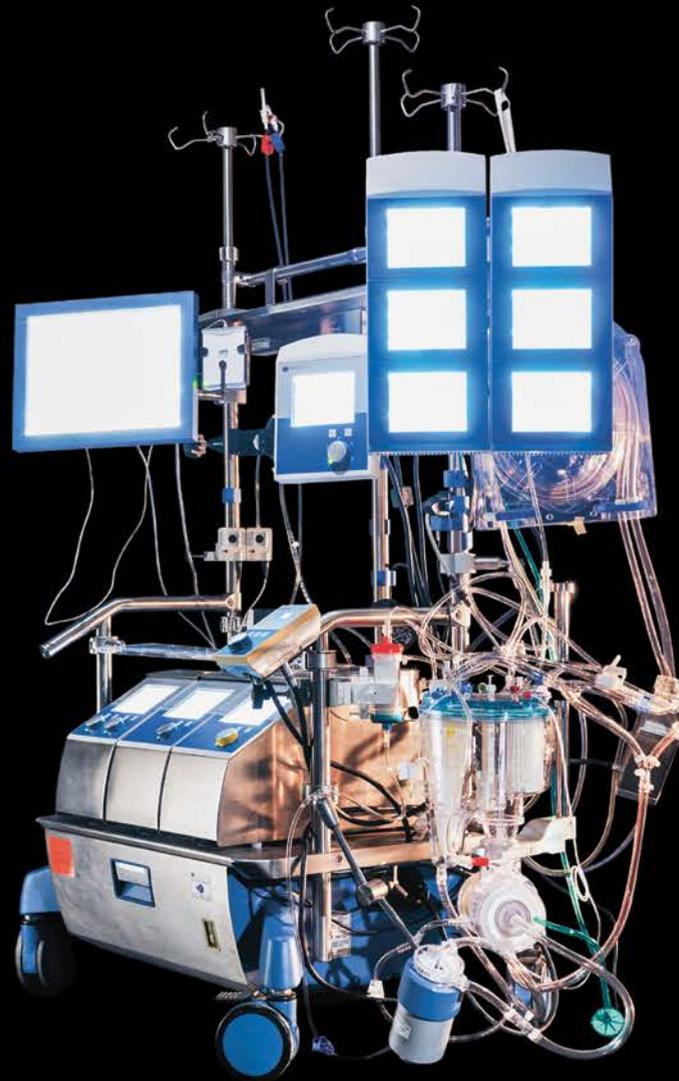
The opinions in the articles are those of their authors and do not necessarily reflect those of the SNSF and/or SA. Research presented is generally supported by the SNSF.

The SNSF

The SNSF is the principal body for the promotion of scientific research in Switzerland. It is mandated by the Confederation to promote basic research in all fields and disciplines and each year distributes some 755 million Swiss francs amongst more than 3,500 projects involving about 8,750 scholars.

The Swiss Academies

Also mandated by the Confederation, the Swiss Academies of Arts and Sciences are committed to an open dialogue between science and society. They are on the side of science, each specialising in a respective domain, yet also acting in an interdisciplinary way. Being anchored to the scientific community rewards them with access to the expertise of around 100,000 researchers.



Life and death at the touch of a button: The heart-lung machine keeps people alive in comas and during operations.

Photo: Reiner Riedler/AnzenbergerAgency

“There’s no good time
to present inconvenient
findings”

Dominik Hangartner page 29

“We work hard and
laugh a lot”

Effy Vayena page 37

“In small groups it’s better
to punish uncooperative
members”

Matthias Wubs page 42