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Researchers, enter parliament!

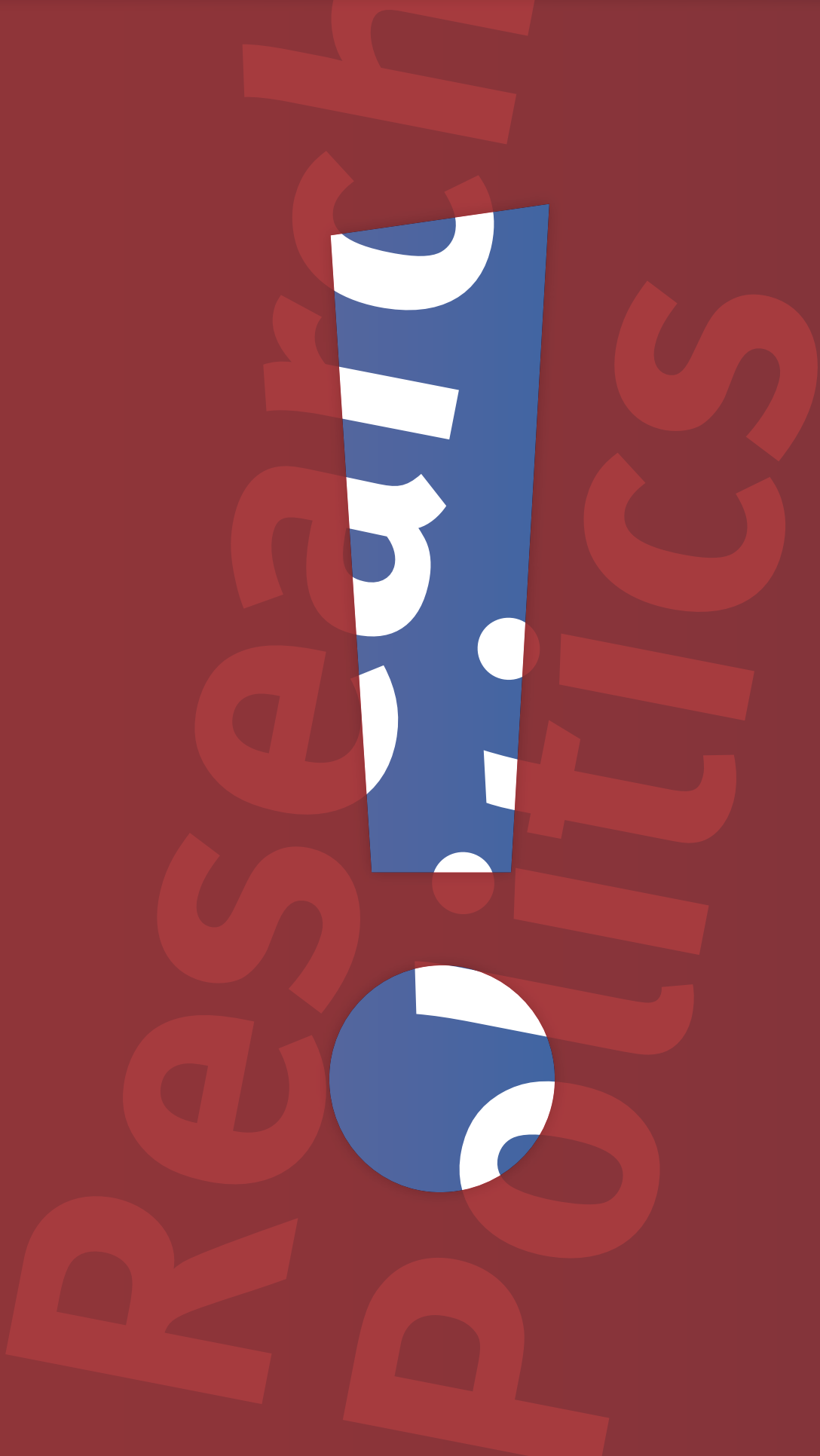
The focus of this issue is 'Researchers in politics!?!'. Our editorial team were swiftly in agreement about the topic, but not about the punctuation marks. An exclamation mark or a question mark? Felix Gutzwiller, professor of preventive medicine and a member of the Council of States (pp. 13-14) would probably want an exclamation mark, as would the Italian senator and stem-cell expert Elena Cattaneo (pp. 19-20). Urs Hafner sides with Max Weber - who's not lost any of his relevance in 100 years - and would prefer at least one question mark, possibly even a 'shouldn't be' to be added to the title. Science and politics should be kept as far apart as possible, he feels; the autonomy of scholarship is constantly in danger and must be defended against the influence of politics and business (pp. 16-17).

So what now? We ought perhaps to differentiate between the different sectors of society and the people in it. Undoubtedly, scholarship and politics pursue different goals and obey different values and rules. Scholarship will do well to insist on its independence. But politicians are not chosen as representatives of a particular field. It's the person who's elected, with his or her opinions, experiences and abilities. We can expect a professor to be able to work differently in the laboratory and the lobby. If we need more people in politics who share scholarly values, who recognise scholarly methods and possess well-founded scientific or scholarly knowledge, then there's no ifs or buts about it: our title would have to be 'Researchers, take up politics!' in the imperative. And if our scholarly institutions are also of this opinion, then they will have to consider carefully how they might create a favourable environment for it.



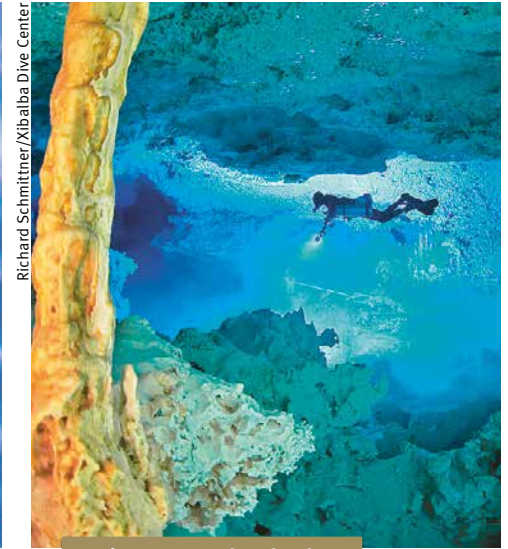
Marcel Falk, editorial board

horizons





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Researchers in politics!?!

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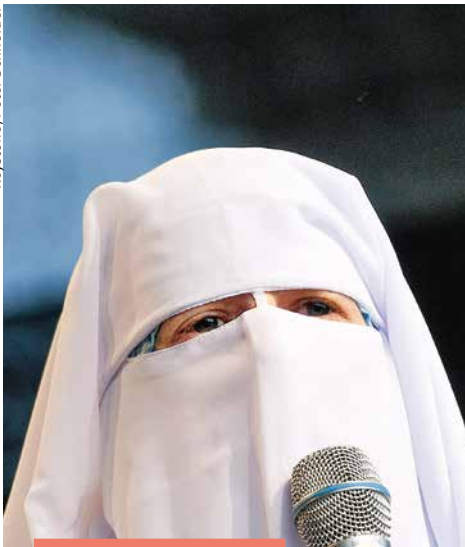
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Arthur in gold

(approx. 1.3× magnification)

“In the Cracow cathedral treasure, there is a golden processional cross that incorporates fragments of two crowns from the second quarter of the 13th century. The more exclusive of the two forms is the horizontal arm of the cross, which can be clearly discerned on account of its markedly serrated edge. Since it has been mounted in one piece, its highly complex imagery can still be read as a narrative in its present, sacred function. It depicts the first Arthurian epic in the German language – *Erec* by Hartmann von Aue – and is the oldest-known example of a mediaeval romance having been retold in craftwork form. Along with the monumental Yvain frescoes in Rodeneck Castle in the Southern Tyrol – which were painted at almost the same time – this crown is also one of the earliest-ever artistic depictions of profane literature. Its secondary, liturgical function meant that the crown was withdrawn from the public domain. The *Erec* cycle is here told in full for the first time and made accessible to those interested in the mediaeval period”.

This is the dust jacket copy for a monumental book about a monumental cross. To a natural scientist accustomed to dry, formless texts, it is difficult to believe that this book is also a doctoral dissertation. Joanna Mühlemann completed her doctorate at the University of Fribourg. She writes the following in her preface: “My interest in the crown-cross and in the *Erec* cycle on its horizontal axis is rooted in an engagement with the history of the royal city of Cracow where I grew up. For someone accustomed to crossing to and fro between two different cultures, it also fulfils a typical need for synthesis, along with requiring a sensitivity for what is foreign in what initially seems to be familiar (and vice versa)”. *va*

J. Mühlemann (2013): *Artus in Gold – Der Erec-Zyklus auf dem Krakauer Kronenkreuz*. 368 pp., Michael Imhof Verlag.

Photo: Stanislaw Michta

The future of the dictionary

The *Historical Dictionary of Switzerland* has reached the last letter of its alphabet. Is it also the end for all such dictionaries? Is Wikipedia replacing encyclopaedias written by experts? Not at all, says François Vallotton, a member of the *Historical Dictionary's* Foundation Board. And he's not alone - the longstanding Wikipedian Charles Andrès is of the same opinion.

Valérie Chételat (photomontage)



It was mere chance of the calendar that caused the coincidence of two events of major importance in the field of dictionaries. First there was the entry into receivership of the *Encyclopædia Universalis*. Then there was the launch of the 13th and final volume of the *Historical Dictionary of Switzerland*, marking the end of a very long editorial project (in fact, more than a quarter of a century), which started on paper and then began adding an electronic version in 1998.

We could conclude from this that the encyclopaedia has been rendered obsolete by the new options for research offered by the Internet. There is, however, still space in the future for higher added-value digital projects in the field of science. Specifically, these will offer alternatives - or rather supplements - to crowd-sourced encyclopaedias such as Wikipedia. I will highlight the several prerequisites that may be needed to guarantee such continuity, using the historical dictionary as an example.

There is still a solid reason to develop lexicographical formats in a closed and controlled way, privileging balanced and systemised entries rather than entries that have been enriched in a random and more subjective fashion. And this is particularly true of retrospective formats. A second

avenue is to think about the options for research and for grouping information. We will not be limited to consulting dictionaries through the use of plain text, as is still the case in most online specialised dictionaries. In this area, the handiest instruments are indexing and semantics-enabling, given their leverage potential. In

“Multimedia companies need to break away from the editorial preference for text in favour of sound and images”.

François Vallotton

the same way, we must first also be able to guarantee links to certain reference databases in the specialist areas at hand. Finally, whilst there is broad agreement on the attractiveness of multimedia companies, they still need to break away from the editorial preference for text in favour of sound and images. And audio-visual elements must not be reduced to ‘illustrations’ of the printed text; they must participate on

the same level as the text as part of a global lexicographical concept.

This is the challenge faced by the new *Historical Dictionary of Switzerland* project that is currently being created in close collaboration with the Swiss Academy of Humanities and Social Sciences. This is an excellent laboratory for historians as well as an opportunity to continue a centuries-old Swiss editorial tradition.

François Vallotton is a professor of modern history at the University of Lausanne and a member of the Foundation Board of the *Historical Dictionary of Switzerland*. Vallotton specialises in the history of publishing and of the media.



There is a general association between the growing child seeking to communicate with those around it and the emergence of language. The acquisition of lexical knowledge, however, is just as much an adult affair. Just think of the foreigner in a country whose language he or she doesn't speak. Lexical knowledge allows humans to identify objects and concepts and to communicate them. What is changing today is not the role of lexical knowledge, but the way it is gathered and transmitted on a planetary level.

Throughout history there have been two types of coexistent knowledge: academic knowledge and common knowledge. The first has been set by the erudite and represents absolute knowledge: "this is the sense of that". The second is used on a daily basis and adapts according to that usage. Lexical knowledge is therefore set by experts and recorded in dictionaries, but it is then used in the street by people who are not necessarily so worried about checking whether the meaning they have for a word is actually the correct one.

At the end of 2014 the *Encyclopædia Universalis* headed into bankruptcy, and if we believe the press, this was the fault of Wikipedia, the online encyclopaedia that had "competed against", "disadvantaged"

and then finally "killed" it. This might make one think that the collaborative encyclopaedia opposes traditional editions, but is it not merely their economic model that has been put into question?

With the advent of the Internet, lexical knowledge has entered the digital age, and with it has come its mode of diffusion.

"The future of reference works lies in their ability to integrate into the network of knowledge hosted by the Internet".

Charles Andrès

Publishers of dictionaries and encyclopaedias have adopted online versions to ensure that they remain up to date and find new readers. These paperless editions, however, feature content that is fundamentally the same. Nor does the price differ, despite their costs having been reduced by several orders of magnitude. The 'crowd-sourcing' Internet offers its 'clients' new possibilities, and not just the ability to

answer questions. Internet users can now also take part in building such collaborative works as Wikipedia.

The proof of the capacity of this new model can be seen in the end-of-year figures for 2014. Wikipedia is available in more than 280 languages, and its corpus of articles contains more than 30 million entries.

Wikipedia does not go against the traditional model of gathering lexical knowledge. It complements it. With its ability to distribute the workload, it allows common and academic lexical knowledge to be combined. This means many tens of thousands of articles on Wikipedia in French, German and Italian cite the *Historical Dictionary of Switzerland* as a reference and link to the electronic version of it. This is the future of reference works such as the *HDS*: the ability to integrate into the network of knowledge hosted by the Internet, thereby creating the first universal lexical corpus.

Charles Andrès is a biologist who has been writing for Wikipedia since 2007. He has worked for Wikimedia Switzerland since 2013.



Researchers in politics



Felix Gutzwiller argues in favour of having more researchers in parliament. Because politics are increasingly confronted with big scientific problems.



The sciences should defend their autonomy and bear in mind the political dimension of their work, but without entering the political arena, says Urs Hafner.



Italy is a good example of how important it is for researchers to get active in politics, reports Mirko Bischofberger.

Allergy prevention?



Pathogens?





“The importance of researchers in politics is underestimated”

Felix Gutzwiller is a member of the Council of States and an expert in preventive medicine. He talks here about local sensitivities, cosmopolitanism, the importance of science in politics and the significance of pure research.

By Mirko Bischofberger

Prof. Gutzwiller, do you think more researchers should enter politics?

I think so. In a well-functioning democracy, it's important that all fields should be represented in politics. When I look at the composition of parliament today, I have to admit that there are very few parliamentarians who have research experience. For several years I was the only member of a university faculty sitting in the Council of States!

How did you come to be in politics?

As an epidemiologist and a doctor of preventive medicine, one naturally works in relative proximity to political topics. For example, as a scientist I have been very much involved in how to organise our health system, which is a politically important topic. So for me to go from research to politics wasn't as big a step as it would have been, for example, for someone coming from quantum physics.

How important is science in everyday political life today?

Very important. Politicians are being increasingly confronted with big scientific issues. I'm thinking here of climate change, energy, nutrition, epidemics and the health system, to name but a few. So in future, research will be an important topic in politics and a decisive driver of our prosperity. This also opens up space and potential for

innovation and progress. And I'm very confident that science will deliver answers – provided that politicians offer the right conditions for it.

Should more researchers enter parliament?

The importance of having researchers active in politics and in parliament is often underestimated. Just think of agriculture, for example: it is often better represented in parliament than are the sciences. And that bears fruit. Farmers have been able to assume a far greater prominence in parliament. That's why it's important for scientists to be represented there as well. I'm convinced that there are enough researchers who would be ready to stand up and be counted. But they have to be made aware of it. And I believe that the SNSF could also contribute by challenging the members of its Research Council to become more active in politics.

Why are there so few researchers in politics today?

Research in Switzerland is more international today than it used to be. Roughly half of our scientific élite comes from abroad. That's very good for our competitiveness, but it also has disadvantages. For example, many researchers know too little about the Swiss political system. And perhaps they often don't understand that it might ultimately be a Herr Meier from a tiny little town whose vote tips the balance in a referendum. Politics in science, like politics anywhere, has a lot to do with a local understanding of the direct democratic processes in Switzerland. And here, researchers certainly have room for improvement.

Are you thinking of the vote in favour of the mass immigration initiative?

Yes, but not just that. At the time of the gene protection initiative in the 1990s, we walked up and down the Bahnhofstrasse together with the Swiss Nobel Laureate Rolf Zinkernagel, carrying political placards. People were impressed by that! It's important and credible when people from the world of research make a stand in politics.

What role did research play last year in the mass immigration initiative?

The mass immigration initiative touched an important nerve in the general population that went far beyond matters of



“To keep the Swiss research scene purely national would be a huge step backwards for research”.

research. There's tension between local and regional issues and our claims to cosmopolitanism. Thus a politically fundamental contradiction has opened up between our access to international knowledge on the one hand, and a purely national need on the other.

What's the solution?

That's a difficult question. Our citizens will probably have to get used to the idea that you can't have both. Affluence in a country low in natural resources such as Switzerland is founded on innovation and research. And these in turn prosper thanks to a certain degree of openness to the outside. To think that Switzerland can flourish with mere local innovation on a national level is completely false in my opinion. It is precisely for this reason that it will be decisive in the coming years whether or not Switzerland is going to be integrated into the European science community. To keep the Swiss research scene purely national would be a huge step backwards for research!

But Switzerland already stands at the forefront of research in the world today, especially with regards to patents and innovation.

Indeed. And it seems to me that young researchers today have more of an entrepreneurial vision than was the case in previous years. There is clearly a greater readiness to ponder how ideas might be utilised for the good of society - in the form of spin-offs, for example. At least in my field that seems to me to be the case. I think that's extremely positive.

Have you ever branched out on your own?

No, I missed that boat, sadly (laughs). In my field it's not so easy anyway. I've helped to set up lots of things in the non-profit realm, such as in the field of health organisations at the local government level.

Can we see a trend today towards a greater utilitarian thinking in research?

It's important that the economic and science sectors work together. But naturally, we can't have science being used merely as an instrument of business. Furthermore, 'usefulness' is a concept that goes far beyond mere economics. It should also be understood as something relevant to the humanities, such as in the field of

ethics in civil society or in philosophy. This is often far more important than business products. We mustn't define 'usefulness' too narrowly.

Is the concept understood properly on a political level too?

I think so. And it also seems to be clear in the Federal Department that since early 2013 has been responsible for economic affairs, education and research. So as far as I can see, there is also a consensus that 'pure research' - research that can seem at first as if it is without a purpose - often becomes the basis for innovation in the economy.

So what is the goal of pure research?

(laughs) In one of his plays, Bertolt Brecht puts the following words into the mouth of Galileo: "I take the view that the only goal of science is to ease the arduousness of human existence". I understand this phrase, in the context of the play, as very much an applied concept that has an ultimate, practical, utilitarian goal. But this doesn't seem to me to go far enough. Because everything that is beautiful, important and ethical should be included in our concept of utility. Even the discovery of a planet outside our solar system might perhaps serve to ease the arduousness of human existence just a little.

Mirko Bischofberger is a scientific advisor to the President of the Swiss National Science Foundation.

Felix Gutzwiller

Felix Gutzwiller is a politician and a professor of medicine. From 1988 to 2013 he was the Director of the Institute for Social and Preventive Medicine at the University of Zurich. In 1999 he was elected to the Council of States and is currently the Chairman of the Commission for Science, Education and Culture.

Fertiliser?



Biogas?





A difficult relationship

Science is always political. But this does not necessarily mean that scientists should enter politics, even if the boundary between the two fields once was porous. There are many issues involved in what is a difficult relationship. *By Urs Hafner*

Can it be true? That there's a female professor in parliament who's engaged in a vehement campaign against the popular initiative 'Swiss law before foreign laws' that was launched by the Swiss People's Party (SVP)? You can count on the fingers of one hand the number of researchers who're active in politics. And there are hardly any more researchers who've taken an active political stance in public. Politics and science don't seem to go together in a liberal democracy.

That wasn't the case back in the 19th century, when the Old Swiss Confederacy was crumbling. When our modern scientific system was still in its early stages, scholars were often politicians and vice versa. For example, the co-founder of the Swiss Academy of Sciences - which is now two hundred years old - was the fearless Zurich democrat Paul Usteri. He was a botanist, a medical doctor and chief editor of the *Neue Zürcher Zeitung*, in the pages of which he campaigned tirelessly for press freedom. He had a seat in the Zurich parliament as a member of the liberal party and died in 1831 shortly after his election as Mayor. In the new Academy of Sciences, he campaigned both for scientific progress and for the emergent Swiss state. The same was true of Frédéric-César de La Harpe from the canton of Vaud: a geographer, historian and anti-aristocrat who represented Switzerland at the Vienna Congress two hundred years ago. Scholarship and politics seemed to belong together back then.

Would it be desirable for today's scholars to take Usteri and de La Harpe as their example? To nail their political colours to the mast and run for office so that their scientific knowledge could flow directly into politics? Or so that this knowledge might profit from a more practical perspective? Probably not. Already at the beginning of the 20th century, the great sociologist Max Weber realised that scholarship and politics are two quite different things in a parliamentary system. And this is still true today. Politicians fight with all possible means so as to attain power and realise their beliefs; researchers on the other hand dedicate themselves to knowledge and to analysing things in the most unbiased manner possible. They are committed to truth. Whatever ideology they might ascribe to should be secondary. If their private opinions play a role in their work - which is often unavoidable and sometimes even stimulating - then they should at least endeavour to sublimate those views, or account for them when determining their results.

But although scholarship and politics are two different systems with different currencies (truth on the one hand, specific values on the other), in our 'knowledge society' today, they are more closely interlocked than ever. And since its emergence, the state has had obligations to scholarship. Without the work of patriotic historians, the emergent nation would not have developed a unifying mythology; without the knowledge of the hydrologists and geologists active in the scientific academies, no maps would have been drawn up - and these are not just a matter of gratification to hikers, but also offer the populace the means of acquiring a spatial idea of their country.

Osmotic exchange

Being at the service of the state is a balancing act for scholars and scientists. They are supported by the state and could not flourish without it; but they have to be careful to maintain their autonomy, even in a post-national age. Today, scholars and scientists are required to provide useful knowledge - knowledge that is measured by numbers of publications, patents and prizes. The current opinion is that society is dependent on the practical knowledge of scientists. Researchers as 'experts' deliver information that becomes the basis of political decisions; they comment on all possible events and carry out opinion polls. But scholarship is a genuinely critical activity. Its initial task is not to provide solutions, but to question existing routines. For this reason it is fundamentally impractical. Scholarship constructs complexity, it does not reduce it. Whoever expects it to

provide easy-to-apply solutions will be disappointed, though this is precisely what applied and application-oriented research promises. But in fact – as the sociologist Peter Schallberger from the FHS St. Gallen, University of Applied Sciences, explains – research that can be applied so straightforwardly is not research at all. It's merely a service provision.

Research is always political – even when it's unaware of it. It is engaged in a constant process of osmotic exchange with the world that exists outside its ivory tower. One example of this is the 'race research' in Zurich that established itself as an internationally leading school of biological anthropology in the first half of the 20th century. It is discussed by the historian Pascal Germann in a new book entitled *Die Naturforschenden* ('The natural scientists'), to be published in commemoration of the 200th anniversary of the Academy of Sciences. The main protagonists of this Zurich School were Rudolf Martin, who was appointed to the first chair in anthropology in Switzerland in 1899, and his successor Otto Schlaginhaufen. They both regarded themselves as natural scientists who wanted to use exact scientific methods to construct a scientific classification for the human species. Their anthropological textbook, the *Lehrbuch der Anthropologie*, with its technical guidelines for anatomical measurements, was last published in a revised edition as late as 1992.

The trap of political ideologies

The plan of these anthropologists was simple, though difficult to implement. They had to measure lots of people in order to complete their body of knowledge about different 'races' – the existence of such differences seemed to them to be incontrovertible. But they were not just interested in the circumference of the skull or the length of the legs; no, they also wanted to know the colour of the anus and of the mucous membranes of the genitalia. They were convinced that this was the only way to determine unequivocally the colour of human skin. Naturally, no one participated willingly in these meticulous investigations. But as long as the anthropologists were able to conduct their research in areas colonised by Europeans, they had enough different human beings to analyse. After decolonisation, the scientists had to make do increasingly with Swiss Army recruits.

They were convinced that they were acting as real scientists do, pursuing nothing but the whole truth. They were unaware – or wanted to remain so – that the notion of a 'racial theory' is in itself racist, and that by constructing their theory of different races they were also assigning them different values and violating their human

integrity. The Zurich School defined itself as an unpolitical institution. This fact, coupled with their being located in what was seen as a neutral country, enabled them to cooperate both with German anthropologists working in the service of the Nazis, and with scientific opponents of 'Aryan' racism. The reputation of the School remained unblemished.

The scholarly autonomy defined by Max Weber is always precarious. It is threatened by politics and by big business, which both want to harness it to their own ends. This autonomy has to be protected. But if scholars and scientists believe that their autonomy consists of working completely beyond the influence of the political sphere, and if they don't take the time to reflect on their relationships outside the scientific field, then they risk blundering into the trap of political ideologies. The existence of different 'races' was one such trap; another lay in determining the difference between the sexes in the 19th century – for that difference was medically and conclusively 'proven' to be situated in both the uterus and the brain.

Attacks from right-wing populists

Professors shouldn't be repeating any political slogans in the lecture hall, but they should demonstrate to their students that scientific work always possesses political relevance. Of this, the historian Caroline Arni of the University of Basel is convinced. Scholarship and science should be defending their autonomy but at the same time be concerned about the political dimensions of their work, while refraining from jumping into the political arena. They are supported in this primarily by the Swiss Academies of Arts and Sciences, which see themselves as think-tanks and interest groups that deal with the structurally difficult relationship between scholarship and society. This is not just about creating good working conditions for scholars and scientists or about offering expertise to politicians. It's also about protecting the sciences and humanities from the impositions of politics and the attacks of their opponents.

Perhaps our scholarly and scientific institutions should start doing this more vigorously in future, if the political pressure on them gets any stronger. 'Unpopular' intellectuals are already subjected to politically motivated attacks by the tabloid media and right-wing populists. If the institutions of those attacked don't defend them in the media, then they are letting their own credibility be called into question.

Urs Hafner is a historian and a science journalist.

Politics and natural scientists

The paths of science, politics and business have long been closely intertwined. This is well illustrated in the book *Die Naturforschenden* by the historians Patrick Kupper and Bernhard C. Schär. This is a pioneering work because the history of the natural sciences in Switzerland has rarely been investigated. Over fifteen chapters, this book casts a new light on the history of the natural sciences in Switzerland since the year 1800. They show that the Swiss Society for Natural Sciences – today known as the Academy of Sciences – was from the moment it was founded in 1815 not just involved in science, but also in politics. It was the time of the restoration in Europe, and reactionary forces had the upper hand. In the Society for Natural Sciences, the many different factions of the patriotic movement were able to regroup.

The Society for Natural Sciences soon began to create different commissions that could also answer questions in the political arena. One early example is the creation of a commission in 1822 to "investigate and compare Swiss weights and measures", which led to the unification of our system of weights and measures. These commissions provided a scientific basis for the development of state infrastructure. Thus geological maps were important for the federal railway and road construction projects, while meteorological and hydrological research improved weather forecasting. The commissions were often also the predecessors of different offices of the federal administration that were gradually set up after the creation of the federal state – such as *Swisstopo* and *Meteo Schweiz*. The Commission for Nature Conservation paved the way for organised nature protection in Switzerland. It founded the Swiss National Park, and in order to finance the Park it also created the Swiss Nature Protection League, known today as *Pro Natura*.

The book *Die Naturforschenden* will be published in May 2015. It was initiated by the Swiss Academy of Sciences and is part of its activities in commemoration of its 200th anniversary. *mf*

Literature

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For details of the programme '200 years of the Swiss Academy of Sciences', please go to: www.forschung-live.ch.

Protecting our private sphere?



Inner security?





Scientists combat pseudoscience

Research and health care both function best in a country where science policy decisions are subject to transparent rules and based on scientific evidence. Otherwise, pseudoscience and capriciousness soon flourish. A glance at Italy shows just how quickly things can deteriorate. *By Mirko Bischofberger*

There are still sceptics – even in the scientific community – who question the connection between AIDS and HIV. And scepticism is their good right. But gradually, even this minority has been won over to the general view by means of properly conducted studies and watertight arguments. Because here, as so often elsewhere, scepticism is based on ideas that cannot stand up to scientific scrutiny. All the same, there are regrettably still cases all over the world where politicians and the public are taken in by the hard sell of scientific fictions. Even in our neighbour Italy, just two hours by car from Bern, we can find repeated examples of a skewed approach to science, especially in the field of medicine. But Italy is also a good example of how important it is for researchers to engage in the political debate about science – and it also proves how successful they can be.

In 1997, for example, the Italian media reported a new miracle therapy against cancer. This so-called ‘Di Bella multi-therapy’ – a cocktail of vitamins, drugs and hormones – was developed by Luigi Di Bella, a professor at the University of Modena. It was devoid of any scientific basis, with no sound research publications or clinical studies to back it up. But the media resonance was so successful and the pressure

from the public so great that several judges ultimately decreed that it should be offered in local health centres and made accessible to everyone. Many patients were treated accordingly, even though the therapy proved to have serious side effects. Only after recognised cancer researchers in Italy became heavily involved did the then health minister decide to apply the usual rules and demand a clinical evaluation.

A more recent case was in the field of stem cell research in Italy. A dubious company with the name ‘Stamina Foundation’ began offering a therapy using stem cells in 2009. Its founder was one Davide Vannoni, a psychologist who had never published anything about stem cells in any scientific journal but nevertheless promised his patients that injecting these cells would ameliorate several illnesses at once – including Parkinson’s, muscular dystrophy and spinal muscular atrophy. He even claimed it might heal them. Although its supposed benefits had not been tested, just as its risks had gone uninvestigated, the therapy nevertheless found its way into several health centres. In the years thereafter it was used to treat hundreds of patients. Vannoni was also involved in setting up a stem cell company in Switzerland (see box).

No right to miracle therapies

When the stem cell expert Elena Cattaneo from the University of Milan learnt of this therapy, she brought the whole story into the open. Together with other specialist colleagues, she wrote articles for the daily press and for specialist journals, raised the topic at conferences, had telephone conversations with politicians, gave interviews and exchanged information with patient organisations and hospitals. She and her research colleagues also received support from the Japanese Nobel Laureate and stem cell pioneer Shinya Yamanaka. In 2013, the Italian parliament decided to investigate the therapy by means of a clinical study. This decision was controversial because there had been none of the usual preliminary studies that are the prerequisite for launching clinical tests – such as experiments on mice that could give an indication as to whether a therapy might work on humans. All the same, a clinical study would be able to unmask the therapy

“Bad science flourishes when good scientists do nothing”.

Elena Cattaneo



Christian Lüscher

Elena Cattaneo, Italian stem cell researcher and Senator, denounces pseudoscience in Italy.

definitively as nonsense. In the end, the study was carried out and cost the Italian state 3 million euros. In May 2014, the European Court of Human Rights decreed that patients have no right to a therapy that has no scientific basis. The Italian constitutional court endorsed this judgement. This means that in future, miracle cures such as that of Di Bella can be kept in check until there is scientific evidence that they actually work.

Senator for life

Italian procedures for allocating research funds and science jobs are also often arbitrary. Roberto Perotti, who teaches at Columbia University in New York and at Bocconi University in Milan, has collected many examples of Italian research nepotism and put them into a book. One prominent case is that of Fabrizia Lapecorella, an economist who applied for a professorship at the University of Bari in 2002. She was awarded the post, even though she had not published a single article in any of the 160 most important international journals in her field, nor in any of the 20 most important Italian journals. Nor had she ever co-authored a book. The applicant who was the runner-up for the post had a doctorate from the London School of Economics and ten publications in the world's most important journals. Today, Lapecorella runs the Italian government's Department of Finance.

Cattaneo has herself experienced the arbitrary nature of research funding in Italy. In 2009 the national Ministry of Health announced that it was offering monies for multi-year stem cell research. However, at the last moment it decided to exclude funding for research on stem cells from human embryos. No scientific reasons were given for its decision. For Cattaneo,

this meant that she was completely barred from the application process. Instead, Vannoni's Stamina Foundation was given the state funding in question. Cattaneo filed a complaint with the courts in order to contest this award. A decision is still pending.

The cases mentioned here show that we need researchers who are prepared to argue in favour of transparent, evidence-based science: researchers who are prepared to go public about it and take an active role on the political scene. This is particularly the case in the medical field, because it's the health of patients that's at stake. But researchers can also achieve personal success with such a commitment. Thanks to her political involvement, Cattaneo was nominated as a Senator for Life by the Italian President in August 2013, along with the Nobel Prize Laureate for physics Carlo Rubbia, the architect Renzo Piano and the conductor Claudio Abbado. She is now the youngest Senator for Life in Italian history and campaigns in the Senate for decisions to be made on the basis of scientific evidence.

Mirko Bischofberger is a scientific advisor to the President of the Swiss National Science Foundation.

Stem cell therapies in Switzerland

In Switzerland, too, medical treatments are carried out without any basis in scientific fact. For example, there are people who promise to heal neurological disorders by injecting completely untested stem cells. The company 'Beike' in Lugano offers a medical transfer to China where patients can be given these stem cells – all at a cost of CHF 50,000. And the company 'Biogenesis Tech' (also in the canton of Ticino) has promised the same; it was co-founded by the same Davide Vannoni who set up the 'Stamina Foundation' in Italy. 'Biogenesis Tech' is still listed in the commercial register as an active company.

Literature

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R. Perotti (2008): *L'università truccata*. Einaudi.

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Better sun protection?



Health risks from nanoparticles?



Not very sunny here

The European Space Agency's lander Philae tells us about its comet and its mother ship.

“ I've got what lots of people would like: a full-time research job. If everything goes well, my position will stay the same for the next five billion years. I just had to make the routine sacrifice – accompanying my boss Rosetta for ten years through pretty thin air. After brief research visits to two asteroids in 2008 and 2010, Rosetta was called to the Churyumov-Gerasimenko comet in August 2014. She promised me a stable position there with long-term support and lots of time for independent research.

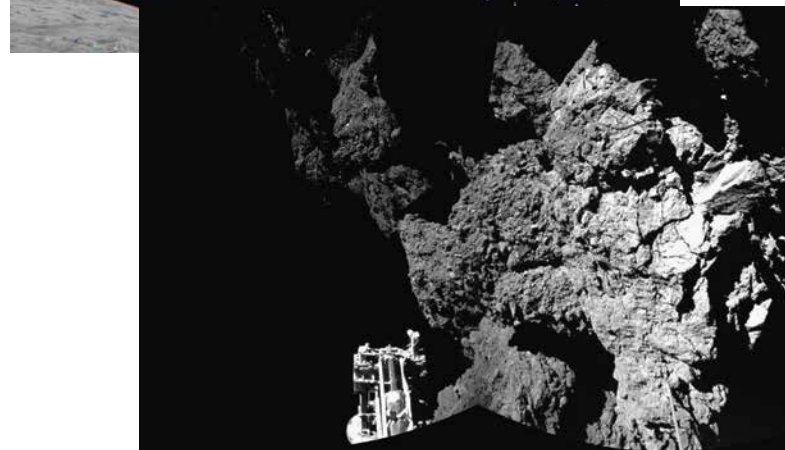
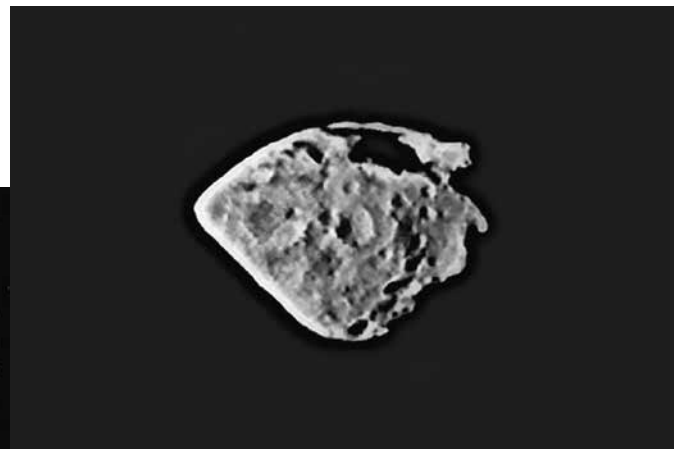
“It wasn't easy for me to say 'Churyumov-Gerasimenko' in one go at first. The name's shaped like a dumbbell, just like the comet itself. But the media attention has made it worthwhile – these days, every radio message I send is reported around the world. Just google 'Philae' and you'll get 13 million hits.

“My equipment's pretty impressive too, including a stereoscopic panoramic camera system and harpoons with temperature sensors, a lot of it made in Switzerland. Incidentally, the thruster on my back (the one that didn't work as planned) is also Swiss. But it's not just because of my faulty jetpack that I'm such a scientific lightweight. The research environment isn't as sunny as promised, either. I've not really been able to get properly settled yet, because the ground underneath me is too icy. What use is a sunset every 13 hours if you're stuck behind a cliff? And there's hardly any sign of long-term support. I only had two-and-a-half days for my first independent experiments.

“Is this supposed to be a stable position? A plannable career would need a decent orbit. But every few decades, Churyumov-Gerasimenko gets too close to Jupiter and then flies off hundreds of millions of miles closer to the Sun. I don't even want to know where that journey's going to take us. If it gets hotter, the outgassing might even blow me into the comet's tail. But it's not the heat that's a problem right now – it's actually minus 70 degrees where I am.

“And what about that independent research I was promised? Well, Rosetta has the last word in everything. All my communications to Earth go through her signal amplifier. 'Rosetta' gets 46 million hits on Google. The German *Süddeutsche Zeitung* wrote about my research activities and even said 'Rosetta is considerably more productive'. And of course Rosetta has just had another whole series of papers published in *Science* without mentioning me even once. I've had enough. I'm going to put my feet up and turn off”.

As recorded by Valentin Amrhein.



Clockwise from top-left: lift-off on 2 March 2004; Rosetta sets Philae free on 12 November 2014 (drawing); the Šteins asteroid, described by the ESA as the “diamond in the sky”, photographed by Rosetta during its fly-by on 5 September 2008; Churyumov-Gerasimenko, photographed by Rosetta; Philae on its approach to the comet (drawing); the first photo from Philae’s landing spot, showing one of the lander’s feet (bottom-left).

Pictures: ESA–S. Corvaja; ESA–C. Carreau/ATG medialab; ESA, 2008 MPS for OSIRIS Team MPS/UPD/LAM/IAA/RSSD/INTA/UPM/DASP/IDA; processing by T. Stryk; ESA/Rosetta/NAVCAM – CC BY-SA IGO 3.0; ESA/ATG medialab; ESA/Rosetta/Philae/CIVA

Philae and Rosetta on Twitter:
@Philae2014
@ESA_Rosetta

Special issue of *Science* on Rosetta:
www.sciencemag.org/site/special/rosetta

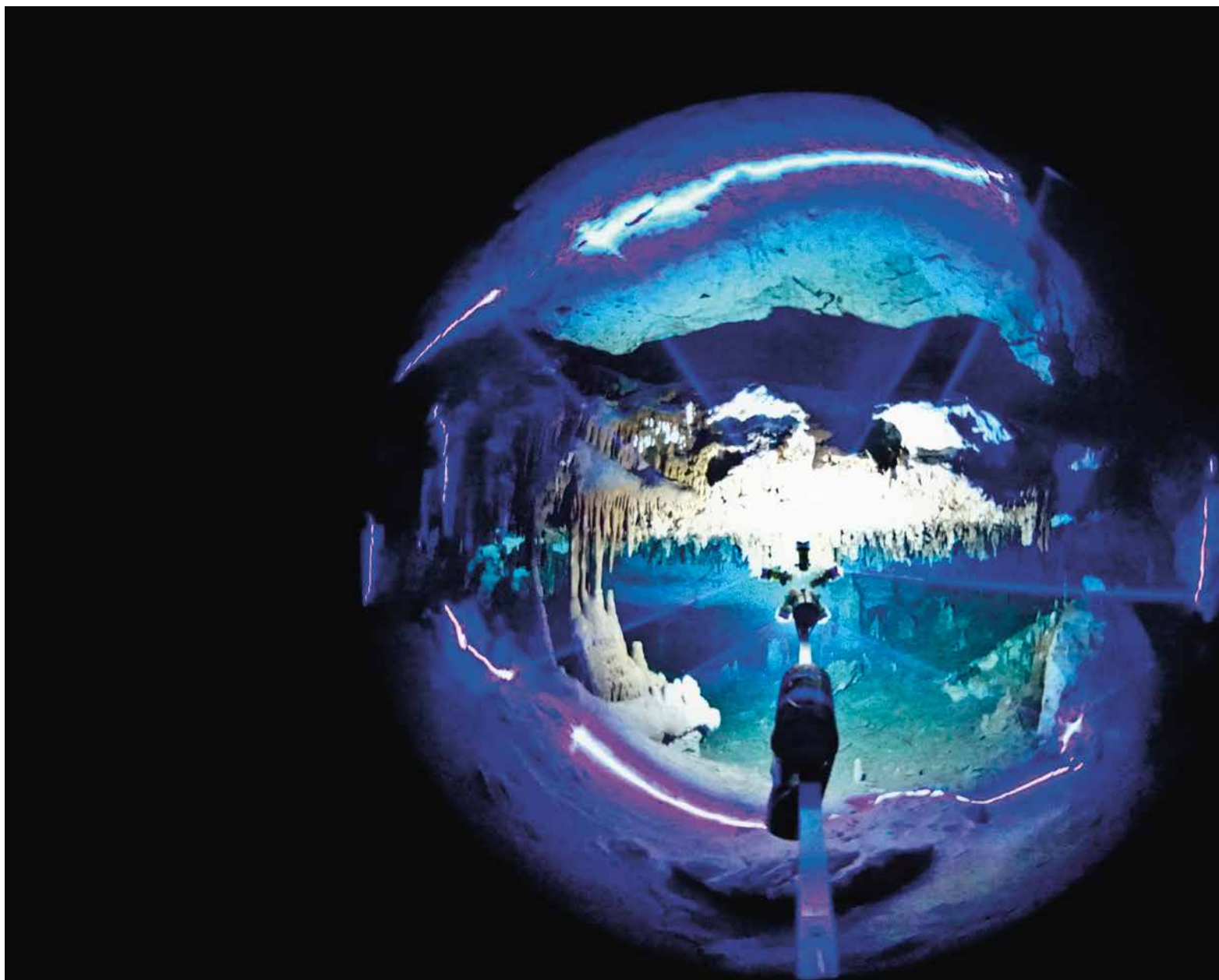
Surveying the underworld

The Mayas believed that the giant karst cave system of the Yucatán Peninsula was the entrance to the underworld. Swiss researchers are now investigating how it was formed - with the help of underwater divers and mathematical formulas.

By Simon Koechlin

There's jungle everywhere. Here in the Mexican state of Quintana Roo on the north-eastern Yucatán Peninsula, the climate is tropical - hot and humid. Yucatán extends from the mainland into the Caribbean like a giant horn. But despite the rainforests and the mangroves, when you drive the 300 miles from Cancún on the outermost edge of Yucatán towards the border between Mexico and Belize, you don't cross a single bridge. This is because the region is completely without rivers or streams - or, to be more precise, without *visible* rivers: water here flows under the ground.

The bedrock is traversed by a huge network of caves. There are hundreds of rock cavities, channels and tunnels, most of them filled with water. Above ground, the



only testament to this hidden labyrinth is the so-called cenotes – sinkholes created when the roofs of caves collapse. There are more than 3,000 of these natural cisterns in Yucatán. This area was once home to major centres of the Mayan civilisation, and the Mayans believed that the cenotes were gateways to the underworld.

One of those Mayan centres was the city of Tulum. Here we find the second-longest and fourth-longest caves in the world. “They are probably even linked to each other, which would then make them the biggest cave system in the world”, says Philippe Renard, a hydrogeologist at the University of Neuchâtel. Together with colleagues from the Federal Institute of Geology in Austria, he’s investigating one of these cave systems: the so-called Sistema

Ox Bel Ha, which is some 160 miles long. The main goal of this research project is to develop mathematical models to explain how such cave labyrinths are formed and how they function.

Dissolving limestone

The prerequisite for porous bedrock is the rock itself: the Yucatán Peninsula is a giant limestone slab that was created over millions of years when the region was still under the sea. Dead coral accumulated and transformed into a plate of limestone over a mile thick. Limestone disintegrates relatively quickly when it comes into contact with carbonic acid dissolved in water, and the result here was a series of clefts, pores and cavities.

Today, the caves are so long that they are filled with sea water for dozens of miles inland. “In areas near the coast, such as in Tulum, a mixture of salt water and fresh water causes the rock to dissolve over the course of millennia”, says Renard. Because saltwater has a lower specific gravity than its fresh counterpart, it forms the bottom layer when the two types of water come together. Rainwater gradually trickles through the porous, chalky soil and flows onto the salt water. The two water types don’t completely mix, instead forming an intermediate layer. “We believe that more limestone has dissolved in those places where this layer occurs”, says Renard.

Renard and his team are using computational models to investigate how the cave system was formed, but by no means are mathematical abilities all that’s needed here. The researchers are dependent on data to feed into their models to test their plausibility, because karst systems are complex. There is a whole series of questions to be answered in trying to determine the extent and the speed of limestone disintegration: What is the precise rock composition? What is the composition of the water, and how do rock and water interact? And, lastly, what substances and sediments are transported through the pores and gaps in the rock?

First, of course, the scientists have to know where the caves actually are, and how big they are. Because to no extent have all of them been mapped. “Our Austrian colleagues track down unknown caves by means of electromagnetic measurements made from a helicopter”, explains Renard.

The helicopter flies above the jungles of the karst terrain and sends out electromagnetic waves into the ground. As these waves travel at different speeds through limestone and water, the researchers can use this method to locate water-filled caves quite precisely.

In order to measure the caves, the scientists have developed an underwater device comprising a laser and a camera. Specialist cave divers take these into the grottos and use them to determine their dimensions. “Divers have also helped us to bring sensors into the caves, with which we can determine the rate of the water flow”, says Renard. Other sensors provide information about changes in the water level in the karst system, and other devices collect data about the properties of the karst rock itself. “Of course, we also use information that other researchers have already published”, explains Renard. “In order to determine the long-term development of the karst system, for example, it’s important to know about the fluctuations in the sea level during the last Ice Age”.

Visibility for 250 metres

It’s too early to be able to offer any conclusive results, says Renard. The mathematical models are still being created by his doctoral students Axayacatl Maqueda and Martin Hendrick, and they’re not finished yet. “But we understand the chemical composition of the groundwater in this region better than we did”, he says. The project’s chemical analyses have proven, for example, that the fresh water alone is far more aggressive than at first believed, even when it doesn’t actually mix with salt water. The high level of groundwater, the tropical climate and the intense biological activity in the region all increase the production of carbon dioxide, which in turn leads to a higher rate of limestone disintegration.

Whilst creating models might be pure research, the project may also yield practical applications, such as preventing water contamination. The inhabitants of Yucatán have used the cenotes as freshwater reservoirs since Mayan times, and the water in these chambers is so clear that visibility in it can extend up to 250 metres. However, hotels and other tourist facilities have been proliferating here in recent years, meaning that giant quantities of wastewater could soon flow into the porous karst rock and contaminate the drinking water. It will only be possible to take appropriate protective measures for this unique geological landscape if we know precisely how its cave systems function.

Simon Koechlin is the chief editor of *Tierwelt* and a science journalist.

Cave divers measure the grottos below sea level with a new device comprising a laser and a camera.

Photo: Arnulf Schiller, Austrian Geological Survey

Computing the bird's eye view

Innovative computer models are allowing us to make more of satellite images. *By Anton Vos*

The use of satellite images of the Earth is becoming more and more popular amongst scientists in a large number of fields such as agriculture, urbanism, forestry, water quality, natural disasters etc. Furthermore, the maps that are created from these images are often published in the media and play an important role in decision-making processes, particularly when it comes to land management. Problems arise, however, when the technical limits of automated computer techniques hold back the extraction of useful information contained in images. A good example of this is comparing two different shots of the same location only to find that the images - taken at two different points in time - vary in their quality, colours or exposure, sometimes to a considerable degree.

These technical limits have been pushed back by Devis Tuia, a professor at the University of Zurich and at EPFL. One of his models has been successfully used to adapt an analysis program for urban structures based on satellite photos. The original program was developed for a specific city but has since been applied to a different city. Conclusive tests have been carried out in Lausanne and Zurich. In a different project,

Tuia has developed a system that allows the comparison of images of the same location but which were taken using different apparatus (satellites, drones or aeroplanes) and therefore do not have the same technical characteristics in terms of spatial and spectral resolutions. Tests were also carried out as part of forestry studies aiming to measure variations in the quantities of different tree species over time.

"The human brain can compensate naturally for differences in the lighting of the same object and can therefore compare two images with different characteristics", Tuia says. "The idea is to teach these kinds of abilities to computers".

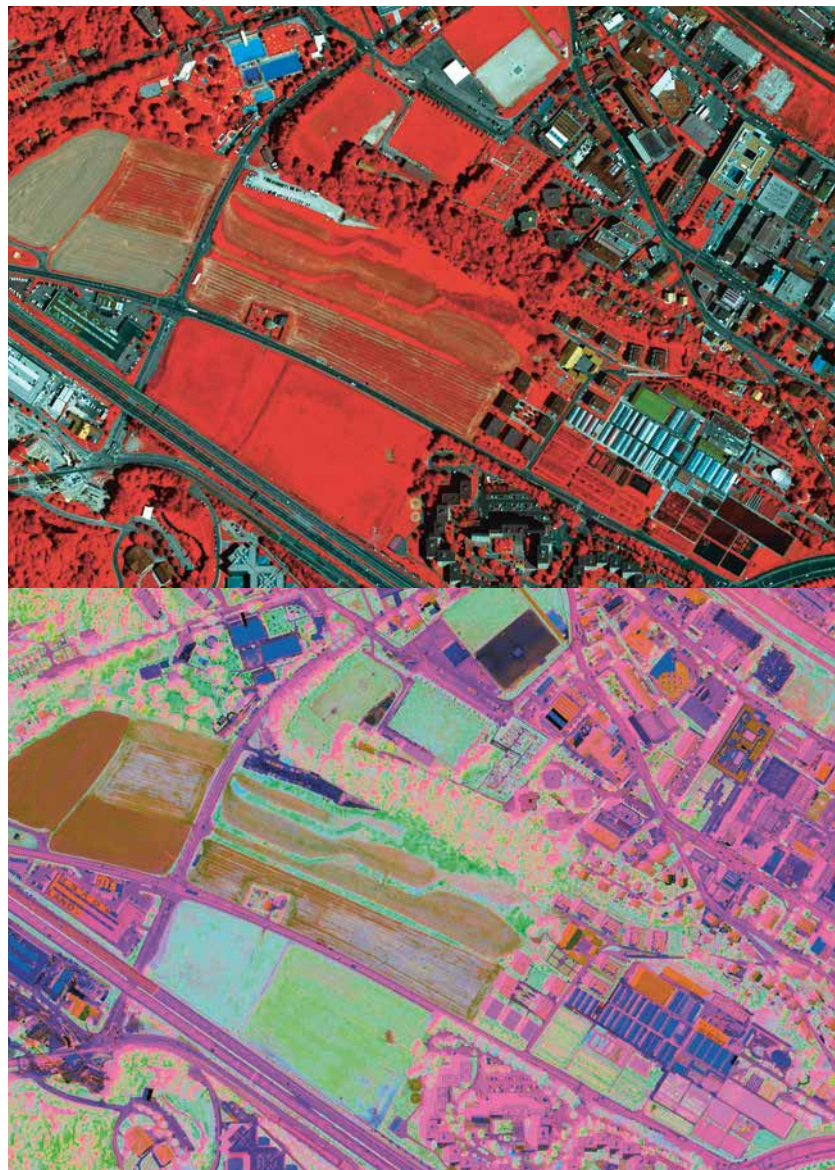
Artificial intelligence

Tuia has managed to do this by using artificial intelligence tools that mean computers learn to adapt to new environments. One step in this process is the 'normalisation' of images, i.e., suppressing all of the

variations caused by the overriding conditions at the time the image was taken and which are not of interest to user. This leaves behind only the useful elements.

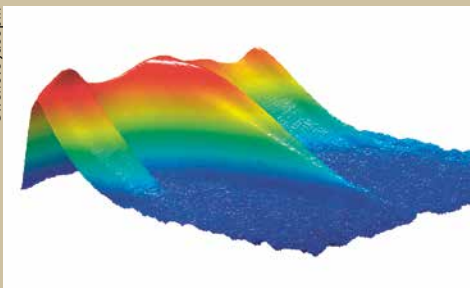
"Studies into the quality of crops in a region, for example, can therefore be done using aerial photographs", he says. "It is actually possible to gather important information on a specific crop by analysing the way in which infrared light is reflected by plants. This does, however, involve first having collected soil samples. But then, if the user wishes to obtain the same information five years later, a model such as the one I have developed means there will be no need to repeat the groundwork, and this can save a lot of time and money".

Anton Vos is a science journalist, working chiefly for the University of Geneva.



Top: Red-coloured surfaces are covered in plants. **Bottom:** Different shades of colour provide information on different types of cultivation. Photos: SwissTopo

Gwénoùlé Jacopin



Chronological sequence (from left to right) of the radiation of a single quantum of gallium nitride.

Unexpected characteristics of blue lasers

Lasers are used in a range of different applications, the most well-known being DVD and Blu-ray players. But the work of the quantum optoelectronic laboratory at EPFL, led by Benoit Deveaud and aimed at a better functional understanding, has shown that these devices display unexpected quantum phenomena.

Lasers are composed of a semiconductor (the most commonly used is gallium nitride, or GaN), through which an electric current is passed. The (negatively charged) electrons combine with (positively charged) holes in the GaN, a process that creates a new particle, the exciton. Excitons then combine to form bi-excitons. This chain of events finally leads to the release of energy in the form of photons, so-called grains of light.

“To understand the specific mechanism of the laser effect, it’s important to know at what point the different particles disappear, leaving the ‘soup’ of electrons and holes that create the plasma that emits the blue light”, says Deveaud. So far, it was believed that excitons were much more stable than bi-excitons; however, “to our great surprise, we’ve observed that when we increased the power in the semiconductor, it was the excitons that disappeared first”. The mechanisms are therefore more complex than the theory first predicted. Specifically, says Deveaud, “it is something which we will most likely need to take into account if we want to create more energy-efficient blue lasers”.

Elisabeth Gordon

Mehran Shahmohammadi *et al.* (2014): Biexcitonic molecules survive excitons at Mott transition, *Nature Communication* 5: 5251

Instruments for detecting and characterising exoplanets

Since 1995 astronomers have discovered almost 2,000 exoplanets. This achievement was only made possible thanks to the updating of existing instruments aboard satellites or linked to terrestrial telescopes. “No other area of astrophysics has seen such a significant impact due to instrumentation”, writes Francesco Pepe in *Nature*. Pepe is a researcher at the University of Geneva’s astrophysics department and a member of the NCCR Planets.

Amongst these instruments is the HARPS South, based in Chile and led by the University of Geneva. This instrument alone has detected “the majority of super-Earths (planets larger than ours) that have been identified since 2004”.

Astronomers have also detected planets with small masses and, since the Kepler telescope was put into space in 2009, they have also discovered objects small in size.

“Knowing that these planets exist is one thing; now, we really want to know more about them”, says Pepe. The task is to measure precisely their mass, radius, density, atmospheric and ground chemical compositions, “which will allow us to understand better how they were formed, how they have changed and whether they are inhabitable”. Also involved in this search is the HARPS North spectrograph, connected in 2012 to an Italian telescope in the Canary Islands, a project also led by the University of Geneva. One other instrument to be used is Espresso, a new generation spectrograph upon which astrophysicists are currently working.

Elisabeth Gordon

F. Pepe *et al.* (2014): Instrumentation for the detection and characterization of exoplanets. *Nature* 513: 358–366

The Geneva Observatory/UNIGE



The HARPS North spectrograph will investigate planets that orbit other stars.

Matt Hoffman



A stream of meltwater above ground is channelled to the bottom of the ice.

Greenland’s wandering ice

Greenland’s ice sheet moves quicker in the summer than it does in the winter. It is influenced by the meltwater that forms in the warm season. This meltwater moves downwards from the surface of the ice, penetrating vertical clefts that run down to the bottom of the ice sheet. From there it flows away through channels under high pressure. The meltwater lifts the ice slightly, which means it starts to glide quicker across the bedrock.

Together with colleagues from America, a research team from ETH Zurich has carried out measurements in western Greenland in order to get a better understanding of what happens on the underside of the ice sheet. They drilled several holes through the ice sheet and down to the bedrock underneath, and then, using movement and pressure sensors, they measured the shifts of the ice and the water pressure.

The researchers have discovered that the ice moves quicker across the drain channels during the day when there is more meltwater, and less quickly at night. A few hundred metres from the drain channels, however, the ice shifts out of phase, thus not in harmony with the inflow of meltwater. In these zones, the movement of the ice is not directly influenced by the water. Instead, the accelerated movement in the neighbouring areas causes strains in the ice that are then balanced out with a time delay. The result is a complex movement pattern in the ice sheet in which the ice creeps forward in a small space like a caterpillar. *Felix Würsten*

L.C. Andrews *et al.* (2014): Direct observations of evolving subglacial drainage beneath the Greenland Ice Sheet. *Nature* 514: 80–83.

According to the calculations of the Republican Left of Catalonia, every person in the region pays 2,622 euros a year more to the Spanish state than they get back. In Belgium, the New Flemish Alliance believes only a 'Flanders exit' can lead the region out of crisis. "It's Scotland's oil", says the Scottish National Party. And the Northern League believes that the north of Italy toils away in order to lay golden eggs into the thieving hands of Rome.



Political parties are normalising nationalism

In Europe, a number of rich regions have called for independence. There are some surprising similarities in the rhetoric of the popular political parties. *By Dominique Hartmann*

From Scotland to Flanders, from the north of Italy to Catalonia, political parties are heralding their separatist intentions. Despite very different ideological, organisational and electoral points of view, there are some similar arguments underlying the calls of the Scottish National Party (SNP) in Scotland, the Northern League (NL) in Italy, the Republican Left of Catalonia (RLC) in Spain, the Flemish Interest (FI) and the New Flemish Alliance (NFA) in Belgium. This is the view of Emmanuel Dalle Mulle, a researcher at the Graduate Institute of International and Development Studies, Geneva. With the exception of the SNP - backed by oil wealth - all of these parties, which are situated in wealthy areas, are relying on the argument of injustice, referring to the way in which taxes levied in their region are transferred to other parts of the country. "It's worth noting that the size of these transfers varies considerably according to the methods used or the years in question", says the researcher. This of course has nothing to do with solidarity; these donations are supposedly leading poor regions to become dependent on a central state. They are judged as excessive as well as being ineffective in the economic convergence of the least advanced regions. This is stopping the development of local activities and engraining

It's Scotland's Oil



a permanent nature to these transfers. Political parties, therefore, consider their own regions to be tied into the development of other regions by what they consider as an economically and socially backwards centre.

In addition to economic victimisation, they also talk of political marginalisation. The two Flemish parties are very quick to recall the minority in Wallonia possessing a veto right on any constitutional changes, which is stopping the Flemish majority and its goal of changing the way the country is organised. This reflects how the economic capacities of the two communities have been inverted, starting with the decline in Wallonia that started in the 1960s. In Catalonia, the RLC highlights the injustice rooted in the failure to recognise the plurinational nature of the Spanish state. "One example: while learning Castilian is a constitutional requirement, citizens are, however, free not to use Catalan", points out Dalle Mulle.

A strong work ethic

These are not modern claims. They began life at the end of the 19th century and led to the widespread creation of the nation-state. It is only the Basque and Catalan forms of nationalism - formed at the beginning of the 20th century - that displayed

this minority model, coming from a more developed periphery and threatening the unity of the state as the five parties do today.

According to Dalle Mulle, these parties emerged on three different levels. From a structural point of view, the nationalism in wealthy regions developed following the opening of large deficits in state finances, which had an impact on the level of public debt and/or taxation. In the 1990s, the traditional Belgian, Spanish and Italian parties were rocked by corruption scandals, contributing to the appeal of alternatives. Alongside this, new cultural paradigms began to spread, beginning in the 1970s. They became the new understanding of the world, justifying the discourse on identity used by these political parties. Dalle Mulle says, "in places where a region's success was based on values such as a work ethic, for example, and not on an unjust sharing of resources, these parties escape being labelled egotistical".

Then European integration and globalisation started to play an important role. "For these parties, the central state appeared to be a negative figure, which is typical in all identity constructions. Europe presented itself as a positive model". This was a place where parties could brandish the values they associate with modernity:

economic progress, meritocracy and fiscal strictness in the case of the NFA, the NL and the FI, and social protection and growth for the RLC and the SNP. The European project also allowed them to reassure their constituents about the costs and the uncertainty often associated with the process of independence, "even though recent history has shown, during the referendum on independence in Scotland, that the European Union requires any state born of secession to submit its own accession request in good time and form". Furthermore, European integration legitimised the discourses of donor regions that wish to reinvest in their local economy using the considerable funds earmarked for transfer, and thereby level out the playing field. There is also globalisation, which has strengthened the importance placed on governance, particularly with regard to state finances and therefore the traditional context in which companies work. This is another factor in competitiveness.

So the favourable election results of these parties are not based just on a separatist discourse, for which there is no majority. In reality these parties have developed ideological profiles which go beyond a simple desire for independence, social democracy for the SNP and the RLC, conservatism for the NL and the NFA and the extreme right wing for the FI. Furthermore, they are committed to independence of the democratic variety: electors therefore know that they will have their say and that they can vote for them despite their separatist goals. "What they have certainly achieved is normalising nationalism and strengthening the regional dimensions within states", says Dalle Mulle.

Dominique Hartmann is a journalist at the newspaper *Le Courrier*.

“We create architecture, and it creates us”

A nation's ideals are reflected in its representative buildings. When the art historian Anna Minta interprets them, she's feeling the political pulse of our democratic culture.

By Urs Hafner

Books, books, everywhere books. On just about every wall of the apartment there's a bookcase filled with illustrated books and brochures. “My partner is also an art historian”, says Anna Minta when she notices the astonished glances of her visitor. In the corner of her study there's a white sheet hung out between the shelves. “The twins have built a cave. They're gradually taking over the whole apartment”. Amidst all these children's games and the books with their texts and images, you certainly feel very much alive in these four walls.

What people build in their habitats, how political communities express themselves in architecture, how democracies represent themselves and how this in turn has an impact on people – all this is Minta's field of research. “We create architecture, and the architecture creates us”. If you know how to read them, our representative buildings can tell us much about our political culture, our cultural ideals and the inner struggles of a nation.

But what about giving us an example? Minta obliges, eloquently tracing out the history of the Federal Parliament in Bern – the ‘Bundeshaus’ – which is a typical tale of Swiss compromise. But there again, how could it ever have been anything else? In the late 19th century, a Capitol was planned for the prominent hill where the university now stands enthroned above the old city. The USA – Switzerland's “sister republic” – naturally provided the model for it. But the project couldn't get majority support. Pro-

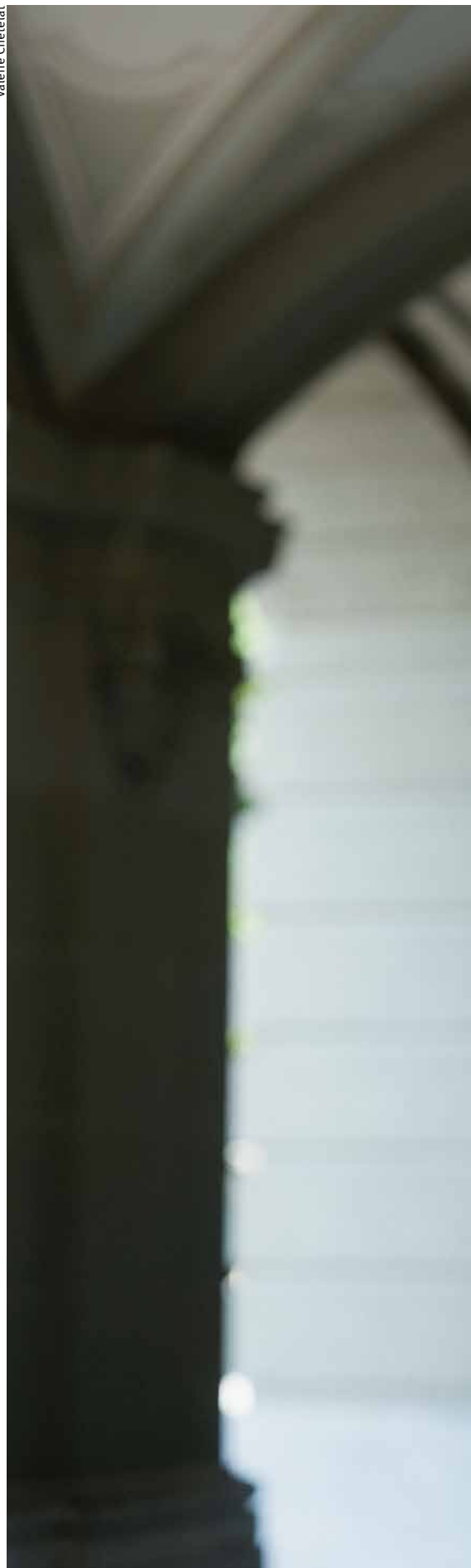
tests from the city's restaurants also played an important role, because they didn't want to see the centre of political power shift to what was then the outer edge of the city. “The influence of business is often underestimated”, says Minta.


The architecture of the Bundeshaus appropriates elements of the Renaissance style of the republican city states of northern Italy. It's recently been renovated, and Minta thinks that it's been carried out with immense success, given its protected status. The building was in part returned to its original state of 1900, and no effort or expense was spared. Though she was astonished that hardly any measures were made to update the building during the renovations – measures such as adding contemporary works of art, which might have signalled some revitalisation of national political ideals. The Reichstag in Berlin, for example, exudes transparency thanks to its glass dome, thereby displaying openly the damage done to the building during the Second World War. The fissures of history are thus inscribed in it. For the government buildings in Bonn, which was the capital of West Germany after the War, an intentionally modest architectural language was chosen: “After the totalitarianism of the Nazis, they wanted to put modesty and openness on show”.

Holy spaces of the modern

Minta is an SNSF professor at the University of Zurich, and in her new research project she wants to investigate the ‘holy

Valérie Chérelat





“People still have a need for sacred systems of symbols and societal institutions of order”.

spaces of the modern’ in the cultural context of Christianity, Judaism and Islam. She will be joined in this by three doctoral students. But do ‘holy spaces’ still exist in our predominantly secular world today? Minta actually finds it highly topical, and sketches out how religions are instrumentalised for political ends, and how they express themselves in both construction and destruction. There is the civil religious tradition in the USA, for example (‘In God we trust’), then the desecration of synagogues, the destruction of sacred art in Timbuctoo, the ‘political religion’ of National Socialism and of Soviet communism, Islamic extremism, etc.

Her visitor is still somewhat sceptical, so Minta embarks on a “little theoretical excursion”. The West is not completely secularised, she says, for the profane hasn’t simply replaced the sacred. People still have a need for “sacred systems of symbols and societal institutions of order”. Religion provided both for centuries – though religion is itself a social construct, as Minta emphasises; “nothing is holy in and of itself”. Until about 1800, the ‘transcendence paradigm’ of the Church was dominant, and it used this paradigm to assert itself as a normative institution that could not be questioned. But then it was replaced by the nation-state. The nation created institutions of politics and art and manifests itself in ‘alternative auratic spaces’, such as parliament buildings and museums. It creates values and communities, and situates them in the past and the future. Just how a nation does this, and what new, seemingly sacred spaces it builds are the subject of Minta’s investigations.

Campaigning for middle management

But Minta isn’t just interested in the ‘numinous’ – the divine that lives in the profane. She’s also a career politician. She sat on the middle management committee of the University of Bern for many years,

campaigning for tenure-track professorships to be set up. She’s happy that she now has an SNSF professorship. This gives her a magnificent opportunity to build up her own research group and to research and to teach. Switzerland has to remain integrated in the European and international research landscape in order to maintain its excellent standards – in that sense, the partial nature of Switzerland’s association with EU framework programmes such as ‘Horizon 2020’ is to her mind a catastrophe.

If Minta hadn’t been given her professorship, she would now be facing an uncertain future. “It happens repeatedly in academia that someone works successfully for years, they write their habilitation thesis, and then they can no longer be employed at their own university. And that’s just not a tenable situation”, she says. So it’s not surprising that young people turn down the chance of an academic career. She wishes that the humanities could enjoy conditions similar to the other faculties, where individual professorships have been transformed into several lectureships, thereby offering new perspectives to the non-professorial academic staff. “That seems to function very well”.

Urs Hafner is a journalist and historian.

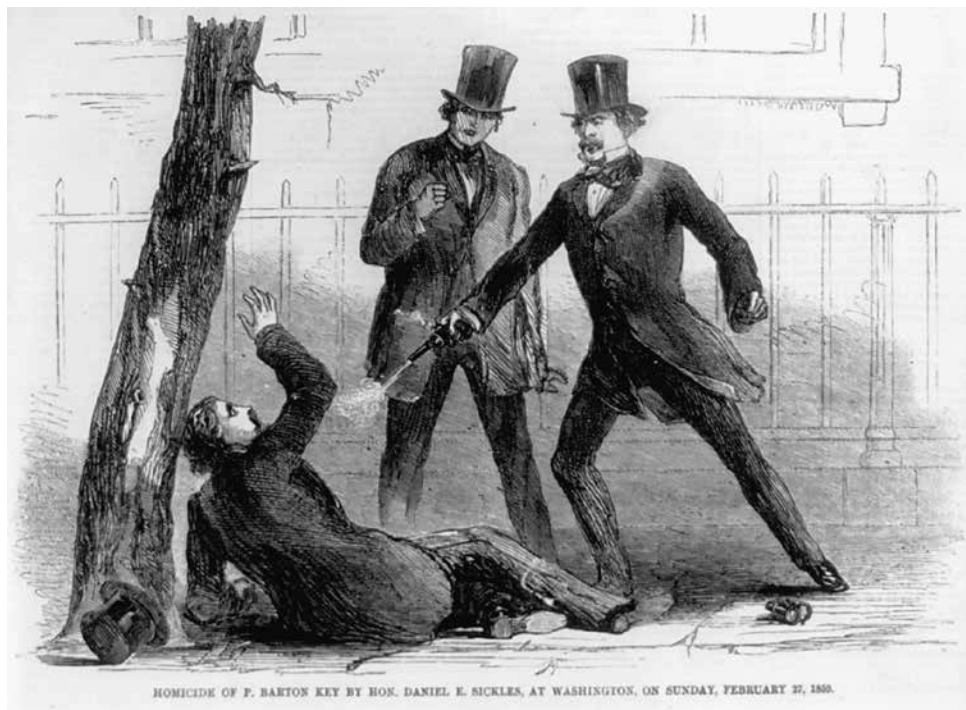
Anna Minta

The art historian Anna Minta is an SNSF Professor at the Institute of Art History of the University of Zurich. Before this she worked at the University of Bern where she researched into the political dimensions of representative architecture in democracies (in Washington, Bern and Jerusalem). Minta was born in Düsseldorf in 1970. She and her partner have two children.

Bloody deeds in Boston and Basel

Murders and killings happen noticeably more often in the USA than in Europe. And that's not a new phenomenon, as a Swiss researcher has now shown. Even 200 years ago there was a greater readiness to resort to violence in Boston than there was in Basel.

By Simon Koechlin



Daniel E. Sickles, a famous general and a politician from the Democratic Party, shoots Philip Barton Key in Washington, D.C. in 1859, after Key had an affair with his wife. Sickles pleaded temporary exemption from criminal responsibility and was acquitted. Picture: Library of Congress Prints and Photographs

Division Washington, D.C. 20540 USA

Violence is part and parcel of the history of mankind. One of the earliest stories in the Bible tells how Cain killed his brother Abel.

In Homer's *Iliad*, the Greeks raze the city of Troy to the ground. And over 5,000 years ago, in the southern Tyrolean Alps, an unknown man shot an arrow into the back of another. The mummified corpse of the victim is known today as 'Ötzi'.

But the history of human violence leaves many questions unanswered. "For a long time, for example, historians only bothered with wars and ignored the violence that takes place in everyday life", says Silvio Raciti, who has completed his doctorate at the History Department of the University of Bern. Furthermore, only a few historical investigations have hitherto delved into whether different places on earth display a greater or lesser tendency to resort to violence.

Thanks to a research scholarship, Raciti was able to compare the type and frequency of acts of violence in Boston in the USA and in Basel in Switzerland from 1750 to 1860. His particular focus was on homicides, and he based his work primarily on court records and newspaper reports. The number of homicides fluctuated, but was higher overall in Boston than in Basel. During the period under investigation there were on average some four homicides per 100,000 residents in Boston each year, whereas the number in Basel was less than

two. Today, the homicide rate in the USA is roughly five per 100,000 people per annum, whereas it's less than one in Switzerland.

"Violence as a means of conflict management was more acceptable in Boston than in Basel", says Raciti. This is obvious from a comparison of the times of the crimes and the identities of the perpetrators. In Basel, physical attacks occurred primarily at weekends and on evenings, and they were carried out almost exclusively by young men from the lower classes. In Boston, however, killings occurred at all times of the day and on work days too. The perpetrators there also included older men and women.

A weak state?

In the USA, the right to self-defence was in any case already far more established back then than was the case in Europe. If you could make a convincing case that you felt threatened, then you could kill an adversary without any danger of punishment, as is clear from an event that happened in 1806. It involved two politicians who had been locked in a long-running battle. When one of them anticipated that they might clash one particular morning,

he took a pistol with him just to be safe. He later encountered the son of his adversary in the centre of Boston, who made as if to hit him with a stick - at which the politician promptly shot him dead. He was later acquitted.

But the imponderability of the US legal system was also responsible for conflict taking a more violent turn there than was common in Europe, says Raciti. Court proceedings lasted a long time, and it wasn't possible for the victim to get financial compensation at the end of it all. People also often fought against the police, who spent most of their time combatting the sale and consumption of alcohol instead of fighting violent crime. This is an important result of his investigations, believes Raciti. The USA's higher homicide rate is often chalked up to the supposed weakness of the state. But in fact the state is just as efficient over there as it is in Europe - "it's just that its resources are deployed differently".

Simon Koechlin is the chief editor of *Tierwelt* and a science journalist.

Basel's socially minded Celts

Over 2,000 years ago, the St. Johann district of Basel was home to Celts. Their settlement extended over some 15 hectares and lasted roughly from 150 B.C. to 80 B.C. In the 19th century, a gas factory was erected on the same site, so when the Celtic settlement was discovered in 1911, it was nicknamed the 'Basel Gasfabrik'. Since then, vast findings have been made, including everyday objects and two grave sites with remains from some 200 burials. For several years now, researchers from the Universities of Basel, Mainz and Freiburg im Breisgau and the Archaeological Soil Research Agency of Basel-Stadt have been analysing these findings systematically.

One of the initial results of this interdisciplinary project has been the discovery of an astonishing genetic heterogeneity among the inhabitants of the settlement. Sandra Pichler, the project coordinator, believes that this was probably because the 'Basel Gasfabrik' was a settlement of supra-regional significance. "Some people came from relatively far away to settle here". It is notable that the researchers have found no signs of any major social disparities – as in matters of food supplies, for example. Analyses of stable isotopes in the bones show almost no difference in nutrition. On average, men did not eat more meat than women. But the varied mortuary practices of the Celts remain a mystery. By no means all of the settlement's dead were buried in the two graveyards. Some bodies were buried in the settlement itself – in certain cases, just body parts or merely skulls – and several bones exhibit incision marks or bite marks of dogs. *Simon Koechlin*



The Basel Gasfabrik settlement in ca. 100 BC, reconstructed from findings from the excavations.



The Tagsatzung of Baden in 1531, in: A. Ryff (1597): *Circkell der Eidtgnoschaft*.

Forgotten assemblies

In the year 1798, Napoleon marched into Switzerland and swept away the *Ancien Régime*. At first he was acclaimed by his new subjects because he brought with him the achievements of the French Revolution, such as legal equality and freedom of expression. The Old Swiss Confederacy had a federal diet called the 'Tagsatzung', where representatives of the individual, constituent states of Switzerland had met regularly. But it was unable to repel the French invasion, just as it had previously been unable to reform the Swiss state. All this has led to its negative depiction in the history books. It is almost completely forgotten today, even though it was the most important institution in the Confederacy. It is clearly more difficult to establish some form of constitutional patriotism than it is to create a successful historical mythology bound up with victory in war.

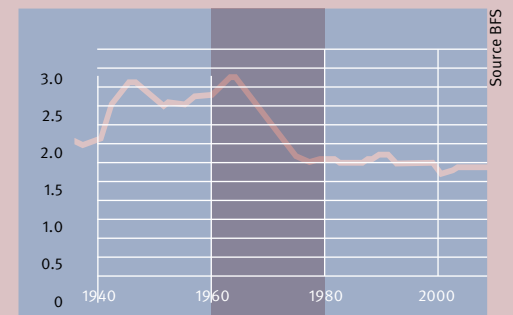
The Tagsatzung was probably the longest-lasting politically representative assembly in world history, but it would in any case have been unable to prevent the French from overrunning Switzerland. Andreas Würgler, a historian at the University of Geneva, does believe, however, that it could have done more to prevent aristocratic incrustation in the 18th century. Würgler has reconstructed the history of this institution in his habilitation thesis more comprehensively than anyone before him. He has found that its formation was prompted by foreign policy considerations in the 15th century at the time when the Old Swiss Confederacy was emerging. Its early years were also its heyday. In 1532, its representatives discussed 768 items of business at no less than 51 meetings. The greatest achievement of the Tagsatzung, says Würgler, was that it held Switzerland together for centuries, even during civil wars – a country heterogeneous in both culture and religion. In 1848, the Tagsatzung was replaced by today's federal Swiss state. *Urs Hafner*

A. Würgler (2014): *Die Tagsatzung der Eidgenossen. Politik, Kommunikation und Symbolik einer repräsentativen Institution im europäischen Kontext (1470–1798)*. Bibliotheca Academica, Epfendorf.

From baby-boom to baby-bust

During the second half of the 20th century, there were as yet unexplained structural changes in the birth rate in Switzerland. At the end of the Second World War, as in the rest of Europe, the number of births increased greatly in what became known as the baby-boom. From 1964 onwards the opposite occurred, in what has become known as the baby-bust. Caroline Rusterholz is a Ph.D. student at the University of Fribourg who has tried to answer this question by looking at the mechanisms of how Swiss families have limited their birth rate.

At first sight, one would quite rightly think of the contraceptive pill. The reality, however, is subtler. "Contraceptive methods had only just appeared in 1964. They were therefore not very widespread at the time of the baby-bust in Switzerland", points out Rusterholz, who has looked at the phenomenon in Lausanne and Fribourg, cities with clearly different economic and religious development, but which nevertheless both experienced the baby-bust. The explanation for this drop in the number of births is explained by something else, linked to cost. "Having a child meant a financial and material cost, as well as a social cost for the parents who would therefore have to give up certain resources and to conform to certain standards", she says. However, the cost would have increased considerably at that time, which would have reduced the desire to reproduce. The question remains as to how to explain this. She suggests that we need to look at the effects of "the standard setters: the media, and the religious and political discourse". The result was smaller families; however, they were families with parents that were more invested in education. *Fabien Goubet*



Swiss baby-bust: number of children per woman.



**“Islam is portrayed
as a problem for
society”**

When there is a conflict about swimming at school or building minarets, it's because all those involved – including Muslims – want to secure their own structures, says the Islamic scholar Reinhard Schulze. But because systems are adaptive, the rules can change too. When it comes to integrating the Muslim population in Switzerland, we have to set up negotiation processes. *By Susanne Wenger*

Prof. Schulze, you've investigated two cases of conflict: the dispute surrounding a Muslim father in Basel who won't let his daughter go swimming at school, and the minaret that was planned in Langenthal but was prevented by the Bernese Administrative Court. How does our society deal with such controversies?

We can't speak of there being a uniform set of problems in either case. And the situations that have been identified as conflicts – the refusal to go swimming and the planned minaret – have resulted in a communication framework that is perceived very differently by all those involved. The different protagonists have their own expectations and assessments of the situation. The courts want to enforce their rules, for example, whereas the officials charged with promoting integration are more oriented to achieving just that. These two positions can stand in contradiction to each other.

So who's being constructive, and who isn't?

You can't put things as simply as that. Behaviour is always linked to one's expectations. The clearest position is the legal one. Since the late 1990s it's been the law that mixed-sex swimming lessons are necessary and compulsory for everyone up to puberty. No flexibility can be expected here – the law is not very adaptive.

But culture can be more flexible about things.

Exactly. The judiciary, the authorities, politicians and the media treat a refusal to join swimming lessons or the building of minarets as a problem. The cultural scene can treat this ironically and play with shifting meanings. The artist who installed a minaret on the roof of the Langenthal Art Gallery in effect placed a question mark against our conventional assessment criteria.

In your investigation, you've noticed a "rejection of Islamic difference". Does that mean that Islam is regarded as 'undesirable otherness' in Switzerland?

All the protagonists, even on the art scene, play with the idea that anything Islamic has to be seen as something different from our society. Islam is portrayed as a problem for society – as if society had a problem with Islam just like it has a drugs problem. This helps to determine the general picture people have of Islam, which accordingly comprises minarets, swimming bans and headscarves. This inevitably stands in contrast to what seems to be the consensus in our society. Thus Islam becomes a 'problem religion'.

Is it really a rejection of Islamic difference when authorities and courts enforce current laws and values?

We didn't want to take a political stance in our study; we wanted to show the backdrop to the decisions that are made. You would

expect that systems would continue to develop and would adjust to new environmental conditions. But as we have seen in Basel and Langenthal, society tends to aim for structural security. Incidentally, this also applies to the Muslims who are campaigning against compulsory swimming at school. They, too, want to safeguard their own structures and are just as unwilling to find a consensus with which everyone can live.

What is the origin of this need to safeguard existing structures?

In an effort to create social and individual security, the present situation is interpreted as something 'other', something that is a danger to that security – even if the situation in itself is far removed from one's own realm of experience. If you don't have any Muslim children, then you're not affected by the problem with the swimming lessons. And you won't ever see a minaret unless you actually live in the area where they're planning one. Nevertheless, it's very easy to decide that these are things you won't accept.

"It's as if society had a problem with Islam just like it has a problem with drugs".

So this has to do with scepticism towards Islam?

It's more a scepticism towards an idea of Islam that reduces it to visible issues: minarets, headscarves, swimming at school, halal slaughter. All these things allow us to construct difference. Many a Muslim would say: what's this strange kind of Islam you're talking about? A belief in Mohammed's teachings doesn't have to create any differences on a social level. But as soon as Islam becomes visible, some people have a problem with it. Correspondingly, even Muslims reduce Islam to what's visible. Then they fight a battle about visibility, right down to radical ideas about the full-body veil.

And the one side goads the other on?

In our current communication framework, the dispute about visibility is indeed blown up into a major problem by all sides. But ultimately it's about integrating Islam into our society. It's been far easier to carry through such integration processes with other issues – in our policy towards drugs, for example. The controlled distribution of heroin is recognised as a matter in which opinions differ, but at the same time the

“Muslim communities emphasise that terrorists have in fact hijacked Islam for their own ends”.

problem has been integrated by means of specific regulations. Islam, on the other hand, seems to be defined as a far bigger problem, and no one's making provisions for its integration.

What's your explanation for that?

The way Islam is judged is based on the notion that Islam is something that fundamentally defines a Muslim. When we see ultra-religious Islamic groupings in the Middle East such as the so-called 'Islamic State', and when we see ultra-religious terrorists attacking and murdering journalists and policemen as just happened in France, then this is perceived as an expression of Islam itself. However, Muslim communities are emphasising that these terrorists have in fact hijacked Islam for their own ends. We have fundamental differences of perception here that we have to iron out.

Instead of reacting to Islamic difference with fines and prohibitions, you write that society could learn instead from diversity. What does this mean in concrete terms?

If society is a system of communication, then it should be able to adapt. Diversity is reality, and it is on the increase. We should consider what new steering possibilities might be found to face this reality adequately, so that we are not simply at the mercy of the processes uncovered by our case studies.

So should we simply accept that Muslim girls won't take swimming lessons?

Research has shown that the learning process is something that applies to society as a whole, including Muslim communities. Inclusion promotes a readiness to reconsider the very positions that one has been using to define difference. Many of our Muslim fellow citizens have long been doing that. Otherwise there would be more discussions about swimming at school, not just individual cases. Muslims in Switzerland turned up their noses at the ban on minarets, but there's hardly any Muslim organisation that has actually insisted on having one.

What would a learning process in society actually look like?

It would mean saying this: integration requires that everyone keeps to all the rules

and regulations of society. But because systems are adaptive, these rules can change. They don't have to change when it comes to swimming at school, but perhaps they could change again with regard to minarets. It's all about negotiation processes within society. The different positions that exist can in fact result in a productive space of social reality.

In concrete terms: how should we approach conflicts about Islam in future?

Let's take the example of the roughly 60 young men from Switzerland who've gone to Syria to fight in the civil war. The old assessment model would promptly make an 'Islamic issue' of this and postulate the existence of difference. An adaptive system would construct channels of communication, and all the protagonists – Muslim and non-Muslim – would sit together and realise that they've got a common problem.

In what sense?

The fact that these young men join up with terrorists is not just a problem for the Muslim communities, but one for Swiss society too. What's going wrong in our families and in our social environment that prompts young Muslims to leave like that? If these are the questions we ask, then we are allowing a learning process to take place and we're making it possible for useful preventive measures to be enacted.

Some of the protagonists – political parties, certain media, but also Muslims too – are cultivating difference quite specifically and sowing the seeds of conflict. And acts of terror like we saw in Paris in January make dialogue all the more difficult.

The structural conservatism we can observe in certain protagonists isn't conducive to an ability to learn, that's true. And this also applies to some Muslims who want to hold on to their otherness. However, the events in Paris have resulted in ever fewer Muslims seeing any latent difference between themselves and our society. Instead, they are emphasising their fundamental objections to terrorism. Their solidarity is towards freedom in society, and this surely offers us an opportunity to overcome our differences.

Susanne Wenger is a freelance journalist based in Bern.

Reinhard Schulze

Reinhard Schulze is the Director of the Institute for Islamic and Middle Eastern Studies at the University of Bern. His key research areas include the history of Islamic culture and knowledge and Islamic religious history.

Swimming lessons and minarets

The studies carried out by Reinhard Schulze and his team deal with the case of a Muslim from Basel who has refused to allow his teenage daughter to participate in mixed-sex swimming lessons at a state school. The authorities fined the father, who then took legal action. He lost his case at the Federal Court in 2012 and later went to the European Court of Human Rights in Strasbourg. At the time of the editorial deadline for *Horizons*, the Court's decision was still pending. Schulze's second case study focusses on the local authority of Langenthal. In 2012, the Bernese Administrative Court forbade building a minaret at an Islamic cultural centre because it was in contravention of local building regulations. The Muslim community accepted the decision. In 2009, the Swiss electorate voted to ban the building of minarets, though the planning procedures for the minaret in Langenthal had begun long before this referendum. It remains questionable to this day just how the ban on minarets would have impacted on the legal dispute in Langenthal. The Administrative Court has offered no comment.

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Maize, maize, maize: monocultures are particularly vulnerable to pests and natural disasters. Photo: Keystone/imageBroker/Jochen Tack

The disappearance of diversity

If we only look at the figures when it comes to biodiversity, then we ignore the real crux of the matter. Because diversity is the essence of life. *By Mathias Plüss*

Science has a problem. Most biologists are convinced that mass extinction is taking place across the world today, but they have difficulty proving it. Only a few hundred species can be proven conclusively to have died out. One of the biggest problems is the lack of proper figures. We can't even pretend to have any idea of the number of species in existence on Earth, let alone each individual population size. Today, we know of the existence of some 1.8 million species. But because many areas are difficult to reach and have barely been investigated – such as the deep sea, isolated jungles and many different soils too – the total number of species could actually be ten or twenty times as many. But even in the case of species that have been described by science, it's more difficult to prove that they've become extinct than it is to prove they exist.

Especially when it comes to rare species, it's highly likely that we've failed to spot the last few of them that are still alive. So scientists are accordingly hesitant to declare any species as definitively dead.

In lieu of anything else, we resort to estimates. It's an undisputed fact that man has destroyed species-rich ecosystems on a massive scale, such as rainforests. A common rule of thumb states that the number of species in a habitat sinks to roughly half when its surface area is destroyed by 90%. But even the validity of this 'rule' is difficult to prove in reality. For one thing, it can take a very long time before species actually die out. This is called the 'extinction debt', which means it can take centuries or even millennia for the final consequences of specific events to take effect and cause species to die out. Furthermore, these rules of thumb were derived from observations

carried out on islands. But ecosystems on the mainland differ from those on islands in one crucial matter: it's far easier for species to migrate. The problem overall is excellently demonstrated by a survey published last year in the journal *Science* by a team led by Maria Dornelas, a biologist from the University of St. Andrews in Scotland. In a large-scale meta-analysis of time series, Dornelas investigated species development in numerous local ecosystems from the poles to the tropics. Her results have caused quite a stir. The number of species decreased in just some 40% of the habitats analysed. In the remainder, the number of species stayed the same or even increased. This sounds like good news – but it's only half the truth. The other half is rather more important: on average, some 10% of all species are replaced every decade in a typical ecosystem. We don't learn any



details about this species-exchange from Dornelas' work, but experience shows that in such processes the immigrant species often displace highly rare, even unique local species. And this is the real threat to diversity.

Immigrants from the south

"If you only work with numbers of species, then you haven't understood what biodiversity is really about", says Daniela Pauli. She's the manager of the Swiss Biodiversity Forum, a competence centre run by the Swiss Academy of Sciences. "The problem is actually the increase in homogenisation. Habitats and species communities are becoming increasingly similar".

Instead of the 'extinction of species', we should rather speak of a 'shrinkage of biodiversity' or the 'disappearance of diversity'. Biodiversity encompasses far more than just numbers of species. It's about the abundance and heterogeneity of organisms, species communities and gene pools. Switzerland is a good example of what's been happening in many other places around the world. We only know for sure of a few species that have actually died out. The total number of species has even increased in recent years - primarily thanks to immigration from the Mediterranean regions, such as bee-eaters that can now breed in Switzerland, thanks to global warming. But at the same time, there has been a collapse in the stock of species that were once prevalent. There's the corn crake bird, whose incessant nocturnal calls annoyed many people just a hundred years ago, but of which just a few dozen are left in Switzerland today. Or there's the lady's slipper, a flower that used to be sold by the bundle at markets in the Jura region, but is today an absolute rarity.

And the dwindling continues. "We're revising the Red List for plants at the moment", says Pauli. "We've noticed that it's the numbers of the most endangered species that have decreased the most - and that's alarming". The main problem remains intensive agriculture, as its fertilisers and irrigation have made many dry grasslands disappear, especially in mountainous regions. And with them, in turn, the plants and animals specifically adapted to that habitat have been disappearing as well. Since 1990, the total surface area of dry grasslands in Switzerland has decreased by a third, and since 1900, some 95% of them have gone for good. Even the few moorlands left have suffered under the impact of fertilisers, and many are also drying out.

The dwindling of small structures in agriculture and the increase in mechanisation had a negative impact on the corn crake. It was almost extinct here by the 1980s, but several male corn crakes can now be heard singing again today.

Photo: Emile Barbelette

As a result, common or garden plants are spreading, such as sweet grasses. "Unique species are being lost" says Pauli. "The species composition of lowland moors is becoming more and more like that of normal meadows". The Biodiversity Action Plan is currently leading a debate about what can be done in Switzerland so as to achieve long-term sustainability for its diversity (see box).

But why should we even bother to protect biodiversity? We often hear the economic arguments: a jungle plant is a potential medicine, and a rare whale can be a tourist magnet. Even an unimposing grass can offer an important service. Botanists at the University of Basel, for example, have discovered that the root structure of the Valais fescue (*Festuca valesiaca*) protects against the erosion of unstable mountain slopes in the Alps and the Caucasus. Also, the use of many a species only becomes clear when it's no longer there. For example, Chairman Mao began a major campaign in 1958 to rid China of its sparrows. Yet just two years later, the Chinese had to begin importing sparrows from the Soviet Union because its populations of insect pests had exploded.

But it can be awkward to argue one's case based on the usefulness of individual species. What is one to say if an economist works out that this or that animal is of no use to humans, and so can safely be eradicated? The true value of diversity can't be calculated in dollars and cents. Diversity is of value in and of itself.

An easy target for pests

The advantages of diversity can nevertheless be clearly seen. Monocultures of any kind are generally vulnerable. In the 19th century the Irish were so dependent on the potato alone that a million people died when potato blight spread. Bananas sold today are mostly from the same species and all have the same genome, which makes them an easy target for pests. These are indeed on the advance, and the consequences are potentially disastrous. Hurricane Lothar in 1999 affected spruce cultures and other monocultures most of all - as did the bark beetle afterwards. Mixed woodlands proved less vulnerable. And let's have one more example: a higher diversity of mammals in forests is proven to provide protection against Lyme disease, a dreaded tick-borne form of encephalitis. Because when other mammals are absent, the ticks primarily attack mice, and these are the principal hosts for Lyme disease germs.

Diversity is a kind of life insurance. Diversity means: adverse events won't affect everyone equally badly. Diversity means: there's always someone there to take on specific tasks. The world is changing, and no one knows what abilities will be required in future. If the individual members of a species are different, then there is a high degree of probability that one of them will be well adjusted to the

environmental conditions that will arise in the future - and this is the basis of evolution. And if a community shelters many hundreds of species, then there is a chance that at least some of them will survive even a drastic change. Thanks to them, the ecosystem will remain able to function.

After the volcano on Krakatoa exploded violently in 1883, it took just a year before botanists found the first grass shoots among the volcanic rocks. By 1886 there were fifteen species of grasses and shrubs on Krakatoa; by 1897 there were already 49, and by 1928 almost 300. Such an impressive re-colonisation would have been unthinkable without all the specialists possessing the right characteristics at just the right moment. That's true in every conceivable situation, in every corner of the Earth. "Biological diversity", wrote the biologist Edward O. Wilson, "is the key to preserving the world as we know it".

Mathias Plüss is a freelance journalist who writes about the natural sciences and Eastern Europe.

Biodiversity strategy

In 2012, the Swiss Federal Council passed a biodiversity strategy for Switzerland. It comprises ten strategic goals that apply to all levels of biodiversity - such as "[improving] the conservation status of the populations of national priority", "[ensuring] the conservation of ecosystems and their ... genetic diversity" and "[developing] an ecological infrastructure consisting of protected and connected areas". Meanwhile, the draft has been presented for the corresponding 2020 Action Plan, on which hundreds of experts have been working. This Plan, along with the measures in it, must now be approved by the Federal Council.

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Managing the flood of information

Increasing digitisation in the fields of communication and science means academic libraries are cultivating closer, more active contact with the scholarly community. This is also necessary in order to make the best use of the vast quantity of publications and raw data we have today. *By Stéphane Praz*

The library is a growing organism” is the last of Shiyali Ranganathan’s five laws of library science – a field co-founded by this mathematician who died in 1972. This law remains valid. However, it seems if anything an understatement to speak only of “growth”, at least with regard to what libraries offer today. “Explosion” would be a more accurate term.

The Internet enables academic libraries to acquire huge holdings overnight – if they have the financial means to get access to the big publishers. They don’t even need any new physical space for this, because the products in question are stored on server farms elsewhere in the world. And the scholarly outputs available online are growing faster than ever before: at present, they double in volume every nine years, according to a study by ETH Zurich.

The digital revolution has changed academic libraries. International networks and new possibilities of interaction with clients are just two aspects of this – think of the new model for libraries known as “Library 2.0”. But these changes are far wider reaching. “Digitisation links libraries closer than ever before with the whole scholarly community”, says Wolfram Neubauer, Director of the ETH Library in Zurich. “Digitisation presents academia with new challenges, and we are the people predestined to meet them”.

Scholars realise this perhaps most clearly when it comes to publishing their findings. While they can access many publications free of charge online without having to visit a library in person – thanks to the open-access movement –, at the same time, it is libraries that offer them the means to disseminate their own work throughout the world. This is because universities and other tertiary institutions have tasked libraries with publishing on their data servers a multitude of open-access texts ranging from doctoral and habilitation theses to conference proceedings and journal articles. They also advise scholars in their relationships with the big open-access publishers such as PLOS and BioMed Central. Publishing work in the open-access format is attractive and is becoming compulsory more often for research findings from publicly financed projects. But open-

access journals also raise certain questions. “Many scientists are concerned about the reputation of some journals and publication avenues”, says Nicolas Sartori, open-access specialist at the Basel University Library. “And when open-access is chosen for the initial publication of research, there’s also the matter of finance”. Open-access journals often involve costs for the authors. However, in the long term they profit from the process, as Sartori confirms. All legal issues are covered that might otherwise arise when their research results are accessed; publications are disseminated quicker; and they are cited more often.

Different data formats

But work that’s ready for publication is just the tip of the iceberg. A vast amount of raw data lies beneath it. Today, every laboratory and every computer simulation produces more data in a single day than whole universities were producing annually until not so long ago. This data has to be archived. This is a major challenge to good scientific practice, because experiments and all the observations they involve have to remain verifiable and comprehensible. This task, too, is increasingly being delegated to libraries, since individual institutes often can no longer cope with the volume of data. Until now, few researchers have considered archiving work for longer than ten years, and there are few coherent guidelines as to how to structure data storage. This was proven by a survey that the ETH Library carried out among 450 professors and research groups. “If we want to leave future generations more than a mountain of data as vast as it is unusable, then we have to organise it according to unified standards”, says Neubauer from the ETH Library. Libraries have the necessary expertise in data management. But without close contact to the scholarly community, nothing will work. This was proven by the ETH pilot project “Data curation”. Data formats differ from one discipline to another, and the structures they need vary just as much. “In some cases, we have to work out good solutions for individual projects in collaboration with the scientists themselves – ideally even before any data has been generated at all”, says Neubauer. The Anglo-American world has already established the concept

of the “embedded librarian”, specialists working from within research teams whose tasks involve organising the structure and the archiving of data.

More subtle search methods

But even before the researchers get around to publishing their work, and before they even start generating data, they have to acquire the knowledge that is already out there. Libraries place this knowledge at their disposal, whether online and freely accessible or on the spot in the library itself. Above and beyond this, libraries see themselves increasingly as mediators of information literacy – the skills that actually enable scholars to carry out information searches in the first place. “It’s information literacy, not user training” – that’s an important difference for Thomas Henkel, specialist for search techniques at the Cantonal and University Library of Fribourg. “We are no longer geared only to our own holdings. Instead we empower scientists to search for, evaluate and use information in the worldwide data jungle”. The information age has clearly done little to promote our ability to search for information. According to Henkel, many students in their introductory courses have little more than the basic knowledge of how to do a Google search. Even academics with doctorates often have just a simple knowledge of Google Scholar, Web of Science or Scopus. “More subtle search methods, such as using Boolean operators, are unknown to many”, says Henkel. Not to mention specific search tools such as the image search for chemical structures offered by Scopus, subject-specific databases and literature administration programs. These aids are almost indispensable today if one wants to search and manage scholarly literature efficiently. Neubauer also sees specialised information literacy as a basic prerequisite for scholarly work: “It has to form an integral component of our teaching”, he says, “just as it does at the many American universities that already practise it today”. But this needs close collaboration between faculties and libraries.

Stéphane Praz is a freelance science journalist.

On an ant's graveyard

Colonies of individuals closely related in their genetic make-up should really be an ideal playing field for pathogens – like monocultures in cornfields. But ants possess a social immunity and astonishing collective defence mechanisms.

By Ori Schipper



Ants don't let their dead sisters rot away in their colony. They carry them out to 'graveyards'. There, after a certain time, the carcasses are often home to a proliferation of fungus spore carriers, a fungus that had already infected them during their lifetime. This fungus grows inside the dead ant's body and draws out the water. It thereby mummifies the corpse – and out of it, ultimately, the next generation of deadly spores sprouts like a thick white fur coat.

For fifteen years now, Michel Chapuisat's team of biologists at the University of Lausanne has been observing an extended population of ants belonging to the species *Formica selysi* in the canton of Valais. Chapuisat has taken spores of *Beauveria bassiana* from one of the ant graveyards for his experiments. This killer fungus, named after the Italian scholar Agostino Bassi, also attacks a multitude of other insects. Bassi proved 180 years ago that the ailment affecting caterpillars in the silkworm cultures that were then widespread in France and Italy had been triggered by a biological pathogen (and he thereby proved the validity of the germ theory of disease before Louis Pasteur and Robert Koch). Today, this fungus is also used as an instrument of biological pest control, for example against scale insects.

"Ant colonies are really an ideal breeding ground for pathogens" says Chapuisat. It's always warm and humid in the colonies, and the hustle and bustle means there's no lack of opportunities for infection. Furthermore, in nests with only one queen, the worker ants are genetically closely related to each other. It's thus extraordinary that such ant colonies aren't simply wiped out – as sometimes happens with monocultures

in cornfields, for example. The resistance of the ants, says Chapuisat, is a result of the species having had enough time – some 100 million years – to develop their astonishing arts of defence against pathogens.

What especially interests him are the collective or social defence mechanisms that depend on the cooperation of different individuals. The fact that there are ant 'graveyards' shows that ants are social beings. "Ants are pretty civilised", says Chapuisat. The existence of graveyards, for example, presupposes that workers place the protection of the colony above their own well-being. Their contact with the dead means they risk becoming infected with the germs, but by carrying the carcasses out it means that the fungus spores can only mature outside the ant colony.

Fighting bacteria with conifer resin

Furthermore, ants possess a so-called 'social immunity'. They don't just clean themselves, but they help to clean their co-inhabitants and their sisters and to keep them as free from germs as possible. Their collective defence is actually supported by the architecture of the colony. A few years ago, Chapuisat noticed that the workers of several ant species were carrying small pieces of hardened conifer resin into the colony. Large anthills can contain up to 20 kilos of this scented material, which is exuded by conifer trees in order to close up their wounds. The substances contained in it inhibit the growth of bacteria and fungi – and this doesn't just work on conifer trees, but also in ant colonies. With this type of collective medication, the insects manage to protect their brood better from germs, as Chapuisat and his team have been able to prove.



For his new study, Chapuisat went to collect ants once more in the Valais, along with his colleague Jessica Purcell. They visited 50 anthills and took 50 eggs and worker ants from each of them. In the laboratory they put the workers of colony A in charge of the eggs of colony B and vice versa. The carer ants had a lot to do. Larvae hatched from the eggs and pupated, then the new workers emerged. Purcell and Chapuisat dripped fungus spores gathered from the graveyards onto the backs of some of these ants. They also exposed the carer ants to the germs. And it turned out that the more resistant the carer ants were, the more resistant were the new workers too. This similarity of immunity cannot be genetically determined, because the experiment used eggs and carer ants from different nests that were unrelated to each other.

“So the social environment influenced the resistance of the ants during their development”, says Chapuisat. Differences in immunity might be traced back to some special behaviour on the part of the carer ants, or to different molecules on the surface of the ants that “determine the scent of an ant nest” and help the ants to recognise their own colony. Or do differences in their resistance to disease originate in differences in the ‘social stomach’ of the different ant colonies? Many workers vomit up part of their diet and give it to the larvae

or other members of the colony, so they also share their microbes with each other. This could play an important role in defending them against pathogens. “There are lots of ideas about this, but at the moment there isn’t much solid data that would support any one explanation”, says Chapuisat.

His investigations into collective defence mechanisms of ants don’t allow us to deduce any strategies to help humans avoid dangerous epidemics. “Our research is not intended to improve protection against dangerous pathogens among people”, says Chapuisat. Together with his team, he’s engaged in basic research, and their interest is in the mechanisms of evolution that promote collaboration between individuals. Fundamentally, these mechanisms also function among us humans – even if that’s only been the case for a few million years for us, and thus a fraction of the time during which social insects have been working together.

Ori Schipper was the science editor of the SNSF and now works for the Swiss Cancer League.

Left: the structure of a nest of *Formica selysi* in the ground. Right: worker ants with a larva.

Photos: Michel Chapuisat; Timothée Brütsch

Literature:

T. Brütsch, M. Chapuisat (2014): Wood ants protect their brood with tree resin. *Animal Behaviour* 93: 157–161.

J. Purcell, M. Chapuisat (2014): Foster carers influence brood pathogen resistance in ants. *Proceedings of the Royal Society B* 281: 20141338.

What's happened so far:

The Ebola epidemic began in February 2014 in south-east Guinea. It rapidly spread to the neighbouring countries Sierra Leone and Liberia, then in early August also reached Nigeria. On 8 August the World Health Organization declared the epidemic to be an international health emergency. In late August they created a roadmap to try and stop the epidemic within the next six to nine months – at a cost of 500 million dollars. By the end of the year, the number of new infections was still rising in Sierra Leone – in contrast to Liberia and Mali. A vaccine developed by Okairos, a biotech company in Basel (taken over in 2013 by GlaxoSmithKline) has been undergoing trials by various research groups since last September, and trials also started in November at the University Hospital of Lausanne. Since December, the tolerance of a second vaccine, developed by the Canadian National Microbiology Laboratory, has been subjected to a large-scale trial at Geneva University Hospital. This study was interrupted just before Christmas, because the test subjects had begun to suffer from unexpected, though minor, side effects.



Special mission: Ebola

Switzerland is playing an important role in managing the Ebola crisis – both in its position as the seat of the WHO and as a centre of research. We offer a glance behind the scenes of a large-scale medical operation that began late, but has been all the more decisive for it. *By Roland Fischer*

For a long time, Ebola was just a distant rumble somewhere on the horizon of tropical medicine. If you use Google Trends to trace the search volume for the word 'Ebola' over the last ten years, then there are barely visible bumps on the scale for 2005, 2008 and 2012, but then, suddenly, a sharp peak in August 2014 and an even higher peak in October. Since its discovery in 1976, Ebola had been an exotic disease far away from us. It was only half a year ago that it shifted into the global consciousness.

This sudden jump in attention also took place in the medical world. There were good reasons for the reticence shown towards it until now. Blaise Genton is a doctor of tropical medicine and the head of an inoculation study currently running in Lausanne, and he explains it in figures: in 2014, Ebola cost 7,000 people their lives. In that same time period, malaria killed almost a hundred times as many. Besides, the earlier Ebola outbreaks had been quickly halted. "Ebola wasn't a priority – and certainly not in Africa", says Marcel Tanner, the Director of the Swiss Tropical and Public Health Institute. "We knew about Ebola, but we also knew that each of its outbreaks had been very limited". This was because the population density and mobility had been low in the affected areas, and because the countries affected had a relatively good health system. None of that applied in the current outbreak, but the World Health Organisa-



Temperature checks at Casablanca airport, October 2014.

Picture: Keystone/AP Photo/The Canadian Press, Abdeljalil Bounhar, file

tion (WHO) did not recognise the seriousness of things straightaway, and so reacted late. Nevertheless, the WHO is being all the more decisive now, both in organisational and in financial terms, and is driving forward the development of a vaccine. Besides England and the USA, Switzerland is one of the scientific centres involved. Large-scale studies are running in Lausanne and Geneva for the two vaccines under trial.

Consciously running risks

But why Switzerland? Claire-Anne Siegrist, the head of the study at the Geneva University Hospital, says that the proximity to the WHO's headquarters has played an important role, as have the well-established contacts between researchers and healthcare officials here. Furthermore, many people live here that will soon be travelling to an Ebola crisis area: roughly a third of all the volunteers taking part in the Geneva study could thus profit already from a vaccine. This is also an incentive for the WHO to allow the studies with the most participants to take place 'on its own doorstep'. It's unusual for a phase I study to be focussing already on the medical use of a vaccine, but time is pressing and so this trial run is being carried out under rather different rules. "One shouldn't proceed so quickly", warns Siegrist, "and we're conscious that it involves risks. But it's justified in this special case". They still endeavour to minimise the risks, which is why the Geneva study

was interrupted shortly before Christmas, when several of the test subjects began to suffer from joint pains some two weeks after having been given the vaccine.

Besides the possible risks for the participants in the trials, we also have to consider that such a fast-track procedure can place a considerable strain on other research activities and on the normal running of a hospital. "These extraordinary efforts are restricted in terms of both time and location - and that's quite right, too", says Siegrist. She would normally have to discuss with the Clinical Trial Unit whether there would be room at short notice for another large-scale study, because the vaccine trial is now taking up three-quarters of its capacity. Other studies have had to be postponed for several months, which is why Siegrist wanted to be sure "that no one was going to die because of this special case". But she has been impressed by the positive spirit of cooperation among all those involved.

'Ebola' proved to be the magic word. Lawyers confirmed contracts within 24 hours, and Siegrist says that those in charge at Swissmedic also reacted quickly and competently. "Believe me, it means something when I say that - I've criticised Swissmedic often enough before", she says. Even recruiting volunteers has been a lot simpler than usual. Both Siegrist and Genton emphasise that the immense effort being invested in Ebola - not just on the ground in

Africa but also in terms of research - is only justified because it promises uses above and beyond this particular case.

Vaccines for haemorrhagic fevers were a secondary research field before now, and there had been hardly any financial incentive to develop them. The main motivation for research used to be the fear that such pathogens could be employed as biological weapons. Genton hopes that we will learn lessons from this Ebola outbreak about how to react best in future emergencies of this kind. But he doesn't want to be distracted from his other priorities: "I will certainly not stop working on malaria", he says. On the other hand, Siegrist is certain that the current study will prove useful far beyond Ebola itself, because a vaccination technique is being implemented that would allow for many other applications. Furthermore, there is a lot to be learnt about how a health system can still function at a high level under such unusual circumstances.

Close partnership with industry

While Siegrist is working with a vaccine developed by the state authorities in Canada, Genton is testing a compound from the pharmaceutical company GlaxoSmith-Kline. He doesn't see any major difference here, because right from the start he had stipulated that "[I] would do my research as I see fit". On the contrary, he is happy to be able to work closely with industry, because he had frustrating research experiences in the past when a compound had seemed very promising in the lab, but hadn't been produced in the necessary quantities to reach the patients. And Tanner also stresses that a swift reaction in times of crisis is only possible if there is a close partnership between the public and private sectors. "10 to 15 years ago it wouldn't have run like this. But since then, we've found ways of reacting jointly to such medical events, to the greater benefit of the general public".

Meanwhile, the control over infectious diseases has become part of the United Nations Development Programme and has been declared a 'global public good'. This category also includes peace, security and climate protection. "A vaccine would be very important for the purposes of prevention, especially if Ebola is going to flare up again repeatedly in future", says Tanner. "But in the current crisis, too, a vaccine could be extremely helpful if it can be put through an accelerated process and used straightaway in the epidemic areas, as long as no scientific or ethical compromises are made".

Roland Fischer is a freelance science journalist.

Ah, sugar, sugar

Are we on the verge of a minor revolution in medicine? In recent years a new category of substances – largely unnoticed by the general public – has increasingly become the focus of research: so-called glycomimetics or ‘dummy sugars’.

By Roland Fischer

If you hear the word ‘carbohydrates’, you don’t automatically associate it with medical matters, but with your own energy balance. Yet sugars are not just burnt up in the human body to provide it with energy. They also play an important role in many biological processes, especially in the communication between cells. Long, often complex, ramified sugar molecules called oligosaccharides sit on the outer membranes and function like keys that can open up the corresponding locks – called lectins – on the surface of other cells. This then sets off a specific reaction. In this manner, carbohydrates play an important role in inflammatory responses, for example.

Their central role in many cellular processes ought to make sugar molecules ideal candidates for new medical agents. But there’s a problem with that, as Beat Ernst from the University of Basel explains. “When I talk about my research and my therapeutic ideas at conferences, I always get the same answer: sugar molecules are too different from classical medicines, which is why they’re not suitable for medication”. There are two reasons for this: first, sugar molecules are highly polar and so can’t get past membranes in the body. This in turn means that they can’t be given orally. You can only introduce them to the body intravenously, but the body then tries to get rid of them quickly. After a few minutes, most of the molecules administered have been eliminated from the body. The second big problem is their interaction with the corresponding

‘docking sites’ in the human body, for this interaction is often very weak when it comes to sugar molecules.

So is this a case of something being interesting in theory, but hopeless in practice? In fact, a minor pharmacological revolution gradually seems to be taking place. There are strong indications that sugar molecules could indeed be used as drugs in future. Thanks to a lot of patience and ingenuity, Ernst’s research group seems to have overcome both problems. Ernst is convinced that both the long wait and his tenacity will pay off in the coming years. “Research is a little bit like boxing”, he says, hinting at his many setbacks and his role as the research underdog. “You have to be able to take punches and, above all, you have to pull yourself up again if you’re knocked to the ground”.

A stir on the stock markets

How have the researchers managed this? The problem with the rapid elimination from the body was solved by a trick already proven effective for a tumour drug, while

the weak interaction with the body’s docking sites has gradually been optimised up to the point where the first active substances can be sent for clinical trials.

Ernst and his research team have been working for 10 years with the company GlycoMimetics. They’re currently causing a stir on the stock markets because of their joint patent, Rivipansel, which is intended to treat sickle cell anaemia, and also because of their promising studies on leukaemia samples. Together with two colleagues, Ernst has recently also founded a company that intends to use dummy sugars for clinical applications against autoimmune diseases. In a further project, dummy sugars are being developed for use against cystitis instead of antibiotics. Ernst expects that their different mode of action will mean that these sugar agents will prove to have great advantages over antibiotics in matters of drug resistance.

Roland Fischer is a freelance science journalist.





All children suffering from cancer should be included in clinical studies.

Treating childhood cancer

Cancer is one of the most significant causes of death among children and young people in Switzerland. In recent decades new treatments have greatly increased their chances of survival. But even five years after a diagnosis and successful initial treatment, the mortality rate among those affected remains ten times higher than among children and young people who have not been diagnosed. Matthias Schindler is currently investigating the reasons for this in his doctoral thesis at the University of Bern. He is basing his work on the Swiss Childhood Cancer Registry, which has been collecting data since 1976 on all children diagnosed with cancer.

Schindler has been able to show that relapses in the first 15 years after diagnosis are the most significant cause of death. Of all the children whose cases he has investigated, four percent experienced a relapse and died as a result. As the children get older, the number of deaths from other forms of cancer increases. But it is also clear that their cancer treatments have consequences too: cardiovascular diseases are more than three times as frequent among the children investigated than is the average for other children of the same age.

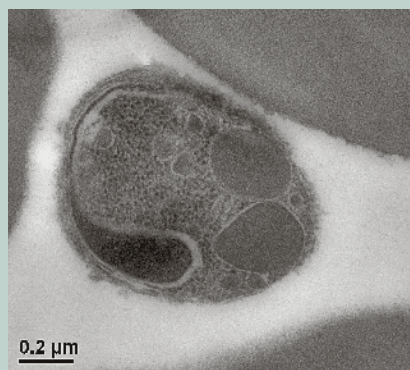
How might we lower the mortality rate even further? According to Claudia Kuehni, Schindler's doctoral supervisor, we're on the right track in Switzerland: "Just as has been the case up to now, as many children as possible who are diagnosed with cancer should be included in controlled clinical studies". She is also calling for a more intensive investigation into the later effects, with the goal of improving the risk-benefit ratio of the therapies. *Thomas Pfluger*

A vaccine cocktail to fight malaria

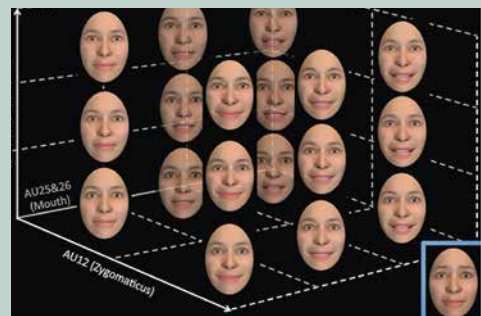
There's a highly promising new approach to developing a vaccine for the tropical disease malaria. It's a combination of several variants of a protein of the pathogen *Plasmodium falciparum*. This protein, AMA1, occurs in nature in several hundred variants, of which the pathogen never carries more than one at a time. It is known that people vaccinated with AMA1 develop antibodies that offer a certain degree of protection against malaria infection. These antibodies offer protection from pathogens with the same or similar AMA1 variants. It has proven difficult, however, to develop a vaccine that works against all pathogens (or at least as many of them as possible) because of the extraordinarily large number of variants of AMA1.

Laboratory tests have been conducted to investigate which antibodies protect against which AMA1 variants by a team of researchers led by Ulrich Terheggen, who was trained at the Zurich Children's Hospital and now works at the Royal Children's Hospital in Melbourne. For this, they've used blood samples taken from children and adults from Papua New Guinea and Kenya who have suffered from malaria. The researchers have also examined what cocktail of vaccines would allow for the broadest degree of protection. Their results show that a vaccine combining three specific AMA1 variants could suffice to protect against infections of the most commonly found variants of the pathogen. Terheggen now hopes that this approach will be pursued further as part of international research efforts to develop a malaria vaccine. *Fabio Bergamin*

U. Terheggen *et al.* (2014): Limited antigenic diversity of *Plasmodium falciparum* apical membrane antigen 1 supports the development of effective multi-allele vaccines. *BMC Medicine* 12: 183.



The malaria pathogen (centre), shortly before penetrating a red blood cell (top-right).



Types of smiles, ordered according to how they activate three different muscle regions.

Imitate to understand

Every day, people we know and people we don't smile at us. A real smile communicates the positive emotions of a person. But smiles can also be false or be grimaces. Being able to understand a smile's degree of authenticity can enable us to adapt our behaviour in society.

Sebastian Korb, a researcher at the International School for Advanced Studies in Trieste, Italy, studies how facial mimicry helps us to decode the sincerity of a smile. When someone smiles at us, the muscles of our own face unconsciously and perceptibly mimic the expression that we are observing. This physical imitation sends information to the brain, helping it to make a judgement. Korb placed electrodes on the faces of subjects to study the micro-contractions of their muscles. The subjects in the tests watched videos of avatar faces, in which the smiles had been manipulated. They then had to judge the authenticity of them. One reaction stood out amongst the results: participants did imitate the expressions of the avatars. What is more interesting, however, is that the intensity of the mimicry predicts the subsequent judgements. The more intense their mimic reaction, the more they believed the smile to be authentic. Furthermore, the study has shown that the Duchenne marker – the crow's feet wrinkles that appear around the eyes whilst smiling – is not the only sign of sincerity. Opening the mouth and the raising of the corners of the lips also plays a role. *Fleur Daugey*

S. Korb, S. With, P. Niedenthal, S. Kaiser, D. Grandjean (2014): The Perception and Mimicry of Facial Movements Predict Judgments of Smile Authenticity. *PLoS ONE* 9(6): e99194

"Showcasing damages science"

Horizons No. 103, December 2014

Critical engagement with research is crucial

I agree with Pius Knüsel that there is a need for debate, both about the relationship between science communication and marketing and about utilitarian strategies of justification. But I don't agree that all efforts to bring science closer to the general public should be sweepingly dismissed as dispensable on the grounds that what's important will "work its way into society regardless".

Whatever Pius Knüsel understands by this, it doesn't happen automatically. It hadn't happened, for example, when a pre-referendum letter to the editor of the *Tages-Anzeiger* claimed that international cooperation isn't necessary for research, because Einstein had supposedly come up with his brilliant theory and won the Nobel Prize all on his own in Switzerland. The writer of that letter clearly has no understanding of how the scientific scene works. But by spreading his opinion and by casting his vote in the ballot box, he has a direct impact on it.

I would also question Pius Knüsel's statement that "mature people are well aware of the societal significance of institutions of science and culture". The ability to assess the significance of something is not just a matter of maturity, it also requires knowledge of the facts. It means you must have the opportunity to engage comprehensively with the topic. This is where science communication comes in. It's not about trivialising science and scholarship, but about education in formal and informal contexts. And the methods employed are developing further and further away from the idea of just 'diffusing' knowledge, and moving instead to participatory models such as 'citizen science'.

However, I do trust 'mature people' to assess their sources of information critically, including propaganda. This is something you learn in media lectures at adult education colleges. In this sense, science communicators could certainly be more honest about declaring where they're coming from, what their perspective is and what goals they're pursuing.

Within the field of science communication, I regard a critical engagement with research and research institutions as crucial. Here I'm of the same opinion as Pius Knüsel. Science journalism undoubtedly has a special role to play in this, because it stands outside the research scene and is in a position to subject it to especially probing questions. But journalism, too, takes place in a concrete political and economic context. It would be better if the content of press releases weren't just repeated wholesale, but subjected to critical analysis

involving the appropriate enquiries – but the conditions necessary for that to happen are regrettably few and far between.

This debate isn't about the 'right' forms of science communication, but about getting those involved to discuss together what their role is, and to make it openly known. In this regard, we're in the midst of a learning process. But it's important to have various forms of science communication so that the inhabitants of this planet can both participate in our society, shaped as it is by research and technology, and be in a position to help shape it themselves, in a manner that is competent.

Hanna Sathiapal, University of Applied Sciences and Arts Northwestern Switzerland FHNW

I would like to congratulate Pius Knüsel on his article – and the magazine *Horizons*, too, for publishing it. "I would ban the superlatives..." is something I can only commend wholeheartedly. We should recommend this phrase to all those politicians who are so keen on realising their scientific fantasies, and to all those university rectors who can't sell their institutes enough amidst the madness of their rankings, their ideologies of excellence and the incessant vanity of their self-emphasising.

Richard Dähler, Zurich

Thank you for publishing Pius Knüsel's article in your magazine. I am 100% in agreement with his diagnosis. The fact that your magazine (well-made as it is) is mostly read by older people from the fields of technology and science merely confirms that these PR efforts will probably result in few new disciples of science. For passionate researchers, utilitarian arguments will hardly have been decisive in their choice of profession, for they are surely driven instead by their curiosity and a kind of play instinct, neither of which is necessarily suited to attracting money. Among the general public, news about the negative impact of technology gets a far bigger response than the overdone communication hype about elementary particles that supposedly travel faster than light. But it's difficult to say what one might do to counter these trends. They are a symptom of the hectic pace of our times.

Werner Sieber, Riehen

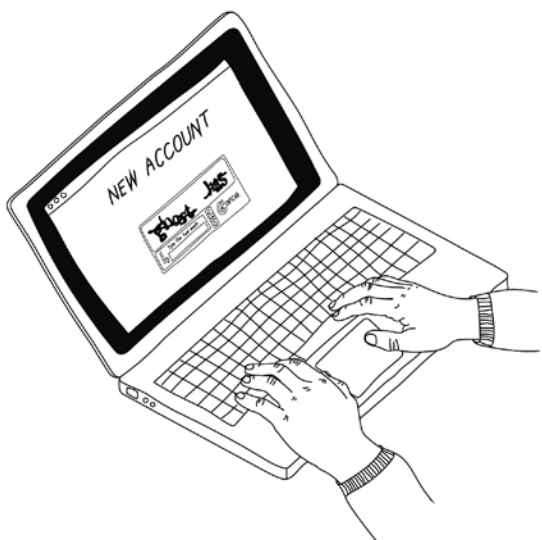
Pius Knüsel's speech at ScienceComm'14 has become the subject of heated debate. As organisers who consciously wanted to stimulate discussion, we're particularly

delighted that his lecture was also published in *Horizons* and thereby disseminated more widely. It is a good thing to discuss the different purposes served by science communication. Undoubtedly, some science communication is devoted to the competition for money and minds that's prominent among our universities and businesses. PR is at the foreground in these cases. But it's important that science comments on current topics, that it presents its findings openly, and that such contributions attract general interest. Substantive communication, generally intelligible reports and syntheses of their findings are what's needed. And ultimately, what's desirable is a discursive form of science communication in which the mass media and other protagonists engage with science and scholarship from different perspectives in a thoroughly critical fashion. Opinion forums, dialogue events and participatory processes can all promote this exchange between science, politics and the general public. It's quite right that too much PR, too many sensational reports (that then often have to be withdrawn) and too much scientific show-business can damage the discourse. And science communicators would do well to act with caution in this regard. The debate has now been launched – let's take it further and keep it going.

Philipp Burkard, Science et Cité Foundation

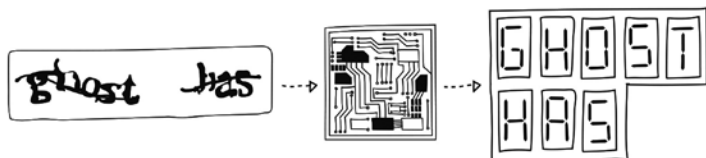
Captcha: the end of twisted words

By Benjamin Bollmann. Illustrations by Eva Antonia Wolf

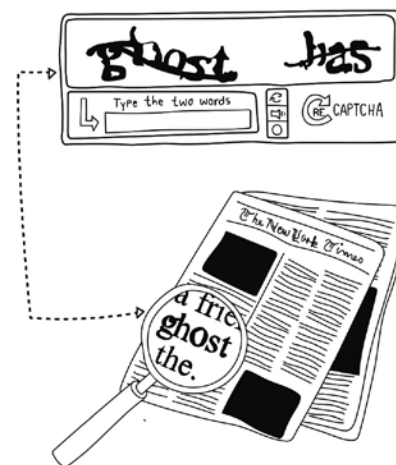


1 Most Internet users have come across the 'captcha' when trying to submit an online form. This security control aims to ensure that the user really is a human being and not a bot, i.e. a computer robot. Underlying this is a form of the Turing Test, as outlined in 1950 by the mathematician Alan Turing to distinguish people from computers. The name 'captcha' stands for 'completely automated public Turing test to tell computers and humans apart'. Captchas are used in the fight against spam e-mails and to prevent online accounts being opened automatically.

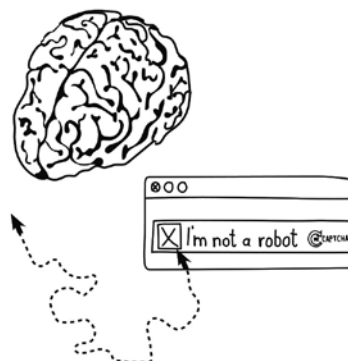
2 Captchas typically require Internet users to recognise deformed characters that are, in principle, legible to humans and indecipherable to algorithms. The Recaptcha service, bought by Google in 2009, exploits this by presenting scanned texts that proved too difficult for their machines to understand. Here the captcha presents two different words side-by-side: the first is to distinguish humans from machines; the second is a piece of text that Google was unable to transcribe. Unknowingly, Internet users are therefore helping Google Books to upload the contents of books and older editions of the *New York Times*.



3 There are weaknesses in the system, however. At the end of 2013, Vicarious, an American start-up specialising in artificial intelligence, announced that it could break 90% of captchas. In April 2014, Google unveiled its own automated system for overcoming this protection with a success rate of 99.8%, which is actually better than humans! Behind this result is an algorithm that recognises characters and which was designed originally to decipher house numbers in the company's Street View images.



4 Google has recently launched a new captcha system of surprising simplicity. All the user is required to do is tick a box next to the statement, "I am not a robot". Its algorithm looks very closely at the online behaviour of the user, analysing the movement of the mouse as it approaches the box, as well as information contained in cookies stored in the web browser. If the software suspects the Internet user is actually a robot, the test is then supplemented with the standard captcha, which happens in roughly 20–40% of cases.



Creating and disseminating lasting knowledge

By Martin Vetterli

Scientific knowledge belongs to all humanity. Whether something was discovered by the Sumerians, the Arabs or the Greeks is of no importance any more: today it's general knowledge. By the same token, scientific knowledge should be freely accessible to everyone, whether it's to be used by scientists themselves or popularised among the public. Exchanging knowledge is a prerequisite for progress,

and holding back information for strategic or commercial grounds has rarely had any positive impact on society.

But scientific knowledge first has to be generated. The litmus test for good science has always been its reproducibility. Results that one scientist has found reliable must be reproducible by others. In maths, where

this process is at its clearest but where nothing is simple, a published proof must be detailed enough for it to be checked by someone else. In other fields, such as medicine or biology, detailed information on the experimental set-up can afford credibility to the results and conclusions. But the experiments must still be detailed in such a manner that others can reproduce them.

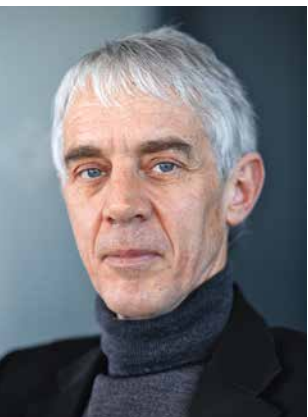
In order to ensure reproducibility, data has to be exchanged freely so that its quality can be tested and its scientific claims confirmed or rejected. This aspect of research was greatly assisted by the introduction of the printing press in Europe by Gutenberg and, later, by the creation of scientific journals and the peer-review process. It's obvious that the invention of the World Wide Web some 25 years

ago will have a similarly broad impact on research in future. This is the challenge of reproducibility in the digital age.

Here's an example: in the year 2002, Grigori Perelman solved a mathematical problem and won the highest award in maths. However, he chose a rather unusual way of publishing his proof: instead of giving his manuscript to a leading maths journal, he put his work on the public preprint server arXiv.org. The result was that it gained immediate attention and was checked straightaway. The whole scientific community acknowledged that Perelman had solved this 100-year-old problem. Even if his approach seems surprising at first glance, nevertheless this case presents all the characteristics of the classical scientific process: a known problem is investigated and its solution published so that other experts can check it. The subsequent consensus confirms that the problem has been solved. All that's unusual here is the missing link in the normal communication process, namely the printed journal, along with the lack of a traditional peer-review process by a few internal experts - though this was replaced by an online review and an open debate on the Internet that was arguably even stricter.

In this sense, the challenge of reproducible science in the digital age is revealed as an opportunity. There are already sufficient online platforms for us to drive forward the process of creating, checking and disseminating new knowledge. And I'm convinced that current trends such as open access and open data are only the beginning of a massive shift towards completely digitised, open science. As the Beatles nearly said: "All you need is sharing!"

Martin Vetterli is President of the National Research Council and a computer scientist at EPFL.



NSRF/Beat Brechbühl

March – June

Science Cafes

Musée d'histoire des sciences, Geneva
Café "La Cavatine", Fribourg
Université de Neuchâtel, Neuchâtel

Until 26 April

"Taupe niveau. Le passé vu du sous-sol"

Musée romain de Vidy, Lausanne

Until 3 May

"Les rois mochica"

Musée d'ethnographie de Genève, Geneva

Until 29 November

"Emotions – Une histoire naturelle"

Muséum d'histoire naturelle, Neuchâtel

1 April

Swiss Global Change Day

Freies Gymnasium, Bern

From May

Envisioning Bodies. From Vesalius up to now

Kulturama, Zurich

5 – 6 May

"Hochwasserschutz zehn Jahre danach"

Congress Centre, Kursaal, Interlaken

9 May

"Tag der Naturwissenschaften"

Kantonsschule, Schaffhausen

From 10 May

"Ausstellung": Quantum of disorder

Museum Haus Konstruktiv, Zurich

30 May – 31 January 2016

"De mémoire d'arbre"

Musée d'histoire naturelle, Fribourg

21 – 26 June

World Food System Conference

Monte Verità, Ascona

28 MINT projects chosen for funding

The programme 'MINT Switzerland', which is endowed with 1.5 million francs, supports projects within the framework of MINT competencies in Switzerland (MINT stands for Mathematics, Information technology, Natural sciences and Technology). The Academies received 158 project proposals for a total of 13 million francs. After being subjected to a multi-level evaluation process, 28 projects were chosen to be allocated funding.

Academies under one roof

In April 2015, the Swiss Academies of Natural Sciences, Humanities, Social Sciences and Medical Sciences will move into new joint premises at Laupenstrasse 7 in Bern, along with the Science et Cité Foundation.



Christine Strub

The best science exhibition of 2014

The Swiss Academy of Sciences SCNAT is awarding the 2014 Prix Expo to the exhibition 'Donne la patte! Entre chien et loup' ('Give me your paw! From dog to wolf') by the Natural History Museum in Neuchâtel. The jury was particularly taken by the successful pedagogical concept of the exhibition, its impressive scenographic design and its subtle evocative power. The Grisons Natural History Museum was awarded the 2014 'Prix Expo for longstanding commitment' in recognition of its exceptional, inventive tradition of communicating science and culture.

Writing courses for young researchers

The SNSF and its partners support practice-oriented media training for scientists. The range of opportunities on offer has now been expanded to include a writing course in German and French for young researchers. On this two-day course, the participants will be coached in the basic techniques of journalistic writing so as

to facilitate communication between researchers and journalists and with the general public. Upcoming courses in German will be held at the Swiss School of Journalism (MAZ) in Lucerne (8 Sept., 14 Oct., 12 Nov. and 4 Dec. 2015) and in French at the Maison de la communication in Lausanne (5 May and 30 Jun. 2015). For further information, please go to: www.snf.ch/schreibcoaching

Swiss web portal launched for the natural sciences

This new portal will bolster communication on the web between Swiss organisations in the natural sciences. Already more than 40 are taking part. Bundling announcements, publications and events on a single platform allows the user to get a quick overview of everything. Topic portals will bring information direct from the source. This web portal is being run by the Swiss Academy of Sciences.

Pilot project for open-access book publishing

As of 1 July 2014, the SNSF has adapted its guidelines for funding publications. It will now also fund the publication of books in digital format that are put on open access within 24 months of publication at the latest. It is up to the authors themselves whether to publish their books in paper form at the same time. In order to gain experience of the process of open-access book publishing along with data on production costs and usage, the SNSF



Eisenhans/Fotolia.com

and representatives of Swiss scholarly publishers have decided to launch a joint pilot project. This project, OAPEN-CH, is intended to contribute to a greater understanding and acceptance of open-access book publishing. In an initial tender, interested scholarly publishers from Switzerland and Germany were invited in mid-February to submit books for the pilot project to the SNSF by mid-April 2015. A second tender will be issued in February 2016. The results of the pilot study will be published in late 2017.

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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

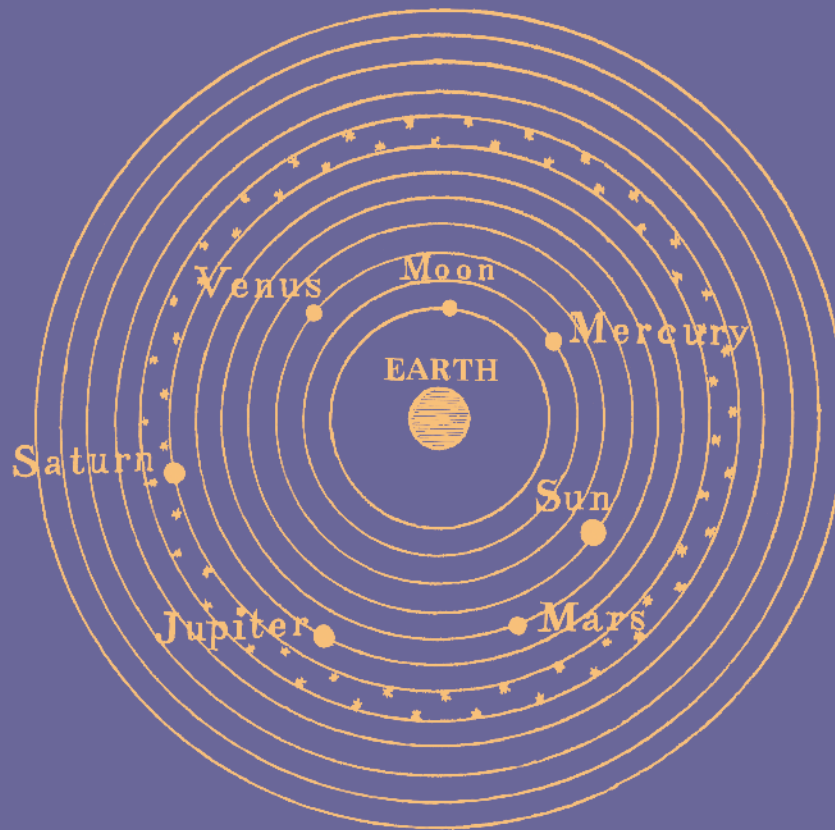
Also mandated by the Confederation, the Swiss Academies of Arts and Sciences are committed to an open dialogue between science and society. They are on the side of science, each specialising in a respective domain, yet also acting in an inter-disciplinary way. Being anchored to the scientific community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

“Research that can be applied straightforwardly isn’t research at all. It’s merely a service provision”.

Peter Schallberger page 16

“Ants are pretty civilised”.

Michel Chapuisat page 42



**Scientific and political:
The geocentric worldview was
valid for 1,800 years.**

Picture: Keystone/Science Photo Library/
Sheila Terry

“The species composition of lowland
moors is becoming more and more
like that of normal meadows”.

Daniela Pauli page 37