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Only true partners find smart solutions

Science is global. Many people assume this means prestigious research partnerships between Western universities, perhaps also involving Asian institutions. But that eliminates half the world from the equation.

In the countries that lie south of the Equator, science is gaining in importance. However, money for research still mostly comes from abroad. This is why research for development purposes largely functions according to the well-known principle of 'he who pays the piper calls the tune' (p. 15).

And so the old power imbalance between donor and recipient is repeated in the research sector. This sector is constantly growing on account of development cooperation with countries in the Global South. But the complex problems of developing countries can't simply be solved by 'help from the West' (p. 22). Local, cultural skills and expert knowledge are needed too. Furthermore, many of these problems also affect the West - such as the consequences of climate change and migration. And events in the South, such as a future Ebola epidemic, could have global consequences. Here, too, the impact of development cooperation is increasingly being scrutinised. Scientific and scholarly methods are being employed to demonstrate what works and what doesn't (p. 12).

Good will alone won't change old habits. This is the reasoning behind the Research Fairness Initiative of the Council on Health Research for Development, an NGO based in Geneva, for example. Its goal is to set up a system of reporting that will encourage governments, businesses, organisations and sponsors to lay open their principles and practices in cooperative research. The Initiative suggests three basic principles for collaborative research: equal opportunity before the start of a project, fair collaboration during the research phase, and equal rights to the findings generated. This should all be self-evident - but it's not.

In just a single issue of Horizons, our journalists cannot possibly hope to cover the whole field of development cooperation and intercultural research in the development sector. And yet the contributions published here demonstrate clearly that Western-centric thinking and research aren't going to lead to the best results.

Pascale Hofmeier, editorial board



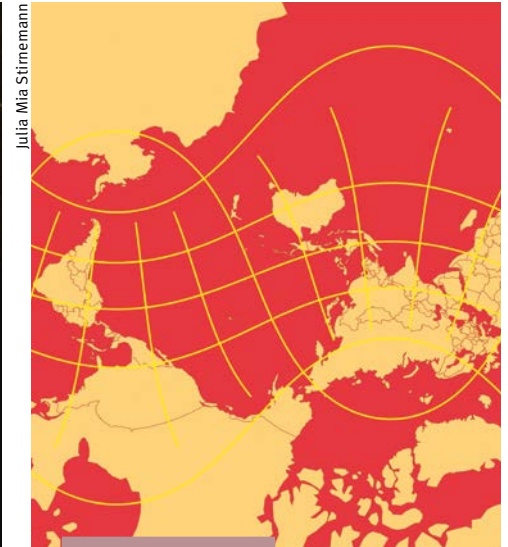
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Photos: 2015 Sylvain Liechti, EPFL/CODEV/EssentialTech

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Marketing disasters

The bourgeoisie – locals and tourists – are shown here cruising in obvious amusement across the Schweizerhofquai in Lucerne in June 1910. Both the River Reuss that runs through the town and Lake Lucerne itself had broken their banks, and the water remained high for five days. “This picture was very much staged, as was the custom at the time”, says Christian Rohr, a climate historian at the University of Bern. He is responsible for archiving historical photos of natural catastrophes. For him, they are an important source of urban and environmental history.

The flood was indeed marketed as an event, and the atmosphere in the city was compared with that of Venice. But the water wasn’t actually that high: “It only reaches up to the knees of the boy in the striped pullover”. The ground was probably dry just a few yards to the left, where the streets slope upwards. And while some people earned money from the flood, others were ruined because cellars and stockrooms were flooded, and entranceways blocked.

The photo also tells another story. When the Hotel Schweizerhof was built in the second half of the 19th century, a broad strip of land was filled up to form the quayside where once the landing stage for the lake had been. It was the time when Lucerne was experiencing an upswing on account of the arrival of the railways, and the city itself was expanding rapidly. “The bourgeoisie wanted to be close to the city centre, yet also wanted to live in green surroundings”, says Rohr.

It’s also instructive to consider what these early photos of natural disasters don’t show. “Up to the First World War, almost none of the fatalities of natural disasters were shown, for reasons of respect”, says Rohr. Even on the photos of the earthquake of San Francisco in 1906, the only dead people you see are those who were tried and shot for looting. *hpa*

Image: Lucerne City Archives,
F2a/Naturereignisse/19/XIV:3-D

Should algorithms be regulated?

Accidents involving driverless cars, calculating the probability of recidivism among criminals, and influencing elections by means of news filters: algorithms are involved everywhere. Should governments step in?

Valérie Chételat, Jim Wallace (photomontage)



Yes

says Markus Ehrenmann of Swisscom.

The current progress being made in processing big data and in machine learning is not always to our advantage. Some algorithms are already putting people at a disadvantage today and will have to be regulated.

For example, if a driverless car recognises an obstacle in the road, the control algorithm has to decide whether it will put the life of its passengers at risk or endanger uninvolved passers-by on the pavement. The on-board computer takes decisions that used to be made by people. It's up to the state to clarify who must take responsibility for the consequences of automated decisions (so-called 'algorithmic accountability'). Otherwise it would render our legal system ineffective.

In many states in the USA, programs help to decide the length of prison sentences given to criminals. This enables the state to lower the recidivism rate and prison costs – but only on average. In individual cases, the judgements passed by the decision-making algorithms can be disastrously wrong – such as when skin colour or place of residence are used as input variables.

Searching for the concepts 'professional hairstyle' and 'unprofessional hairstyle' in the US version of Google will bring up images of light-skinned women and dark-skinned women respectively (in accordance with the 'algorithmic bias'). The data pool that the algorithms use to make their decisions is not always correct. Even if the algorithms use a large number of texts as a basis for their decisions, cultural factors still cannot be eliminated. Stereotypes discriminate. Furthermore, data always refers to the past, and thus only allows for limited assertions about the future.

“People have a right to an explanation about the decisions that affect them”

Markus Ehrenmann

People have a right to an explanation about the decisions that affect them. And they have a right not to be discriminated against. This is why we have to be in a po-

sition to comprehend the decision-making processes of algorithms and, where necessary, to correct them. The same also applies to the ranking mechanisms of the big social networks. What's dangerous about them is not their biased selection of media reports, but the fact that their system's mode of operation remains hidden from us.

Public and private organisations are already working on solutions for the 'de-biasing' of algorithms and on models to monitor them. Even though the big advantages of innovation in artificial intelligence mustn't be stifled, our rights still have to be protected. The EU Data Privacy Act, which will come into force in 2018, offers a sensible, proportionate form of regulation.

Markus Ehrenmann is Head of Business Intelligence and Big Data Architecture at Swisscom in Bern.



No says Mouloud Dey of SAS.

We need to be able to audit any algorithm potentially open to inappropriate use. But creativity can't be stifled nor research placed under an extra burden. Our hand must be measured and not premature. Creative individuals must be allowed the freedom to work, and not assigned bad intentions *a priori*. Likewise, before any action is taken, the actual use of an algorithm must be considered, as it is generally not the computer program at fault but the way it is used.

"It's not algorithms that are at fault but the way they are used"

Mouloud Dey

It's the seemingly mysterious, badly intentioned and quasi-automatic algorithms that are often apportioned blame, but we need to look at the entire chain of production, from the programmer and the user to the managers and their decisions. We can't

throw the baby out with the bathwater: an algorithm developed for a debatable use, such as military drones, may also have an evidently useful application which raises no questions.

We may criticise Google's management of our data, but it would have been a huge shame if the company had folded 20 years ago because of unresolved privacy and data protection issues. New legislation may not even be required. Take, for example, Pokemon Go: the law already prohibits me from endangering other people's lives by playing it.

There are also obstacles to introducing a regulator: the complexity of the mandate, the burden on innovation and the behind-the-times nature of its work, which results from the excessive speed of technological progress. Users must also play their part. I may work in the digital sector, but I'm not on Facebook, as I don't see its utility. You will, however, find me on LinkedIn, despite its algorithms not differing fundamentally.

Citizens should know how algorithms affect them. But let's be frank: the average mortal is not capable of verifying one. In the end, others must be trusted to do so

for us. In this market particularly, self-regulation can succeed, given the proximity of clients to companies and the enormous pressure they wield upon them. It's a company's responsibility to explain very clearly how a system works. Once again, problems arise from the use of a program, not its mere existence.

Mouloud Dey is the director of Innovation and Business Solutions at SAS France and a member of the Scientific Council of the Data ScienceTech Institute at the Nice Sophia Antipolis University.

Interview conducted by Daniel Saraga.

Who decides?

Major sums flow from the West to the Global South to fund development cooperation. But there's much debate about which projects should get funding, how effective it is, and to whom the research findings actually belong.





When there are no functioning incubators, they're cobbled together – but they're barely effective and can sometimes even be deadly to premature babies. Photos: 2015 Sylvain Liechti, EPFL/ CODEV/EssentialTech

The stony path to greater knowledge

Every year, hundreds of billions of dollars flow into development collaborations around the world. But what impact does this money actually have? Critics are arguing for more experimental field research. Experts see an intelligent mix of methods as the ideal way forward.

By Theodora Peter

“No responsible physician would consider prescribing medications without properly evaluating their impact or potential side effects. Yet in social development programs, where large sums of money are spent... no such standard has been adopted”. This sobering conclusion was made in 2006 by a working group of the Washington Center for Global Development, in a provocative report entitled: “When Will We Ever Learn? Improving Lives Through Impact Evaluation”. The experts complained about gaps in evaluating the impact of development collaboration, and called for the systematic establishment of evidence-based decision-making.

The economist and poverty researcher Esther Duflo was one of those who worked on the Washington Report. She had already co-founded the Poverty Action Lab J-PAL back in 2003, a research institute based at the Massachusetts Institute of Technology. J-PAL focuses specifically on randomised field experiments in order to achieve clean measurements of the impact of developmental measures. For example, in a spectacular study, Duflo proved that while the much-praised microloans in India did help to reduce poverty, they did not serve to improve the lives of those affected to the degree anticipated.

This criticism of a lack of standards, along with a call for a greater evidence base, did not go unheeded in the professional community. One answer came in 2008 with the foundation of the independent International Initiative for Impact Evaluation (3ie). This NGO links together scientists with politicians and practitioners, organises conferences on topics such as ‘what

works’, and promotes evidence-based evaluations. Since it was founded, it has supported more than 200 impact studies in 50 countries worth a total of USD 85 million.

OECD criteria are the international guidelines

In parallel with the efforts made by science, the donor and partner countries have in the last decade also been refining and professionalising their evaluation instruments. The Declaration of Paris in 2005, for example, created a basis for common quality standards to determine the effectiveness of development collaborations. The OECD Development Assistance Committee defined five evaluation criteria: relevance, effectiveness, efficiency, impact and sustainability. These are not binding, but they are recognised internationally as a guide for action.

“An evaluation is also about finding out why there is an impact”

Jörg Faust

These criteria are also monitored by the OECD itself in its own country reports. The lack of policy coherence among the donor countries is repeatedly criticised – such as when a country’s foreign policy runs counter to the goals of poverty alleviation. The donor countries themselves evaluate the effectiveness of their development methods. Sceptics cast doubt on the independence of these evaluation units, however, because in most countries they are

situated within the same organisations that are actually giving the money.

Germany struck out on a different path, however, when it created a mandate for an autonomous institute. In 2012, the German Institute for Development Evaluation was founded (DEVal). “We place a great emphasis on a scholarly approach and on independence”, insists DEVal’s director, the political scientist Jörg Faust. “We are also strongly focussed on a hands-on approach and want to initiate learning processes”. The topics they evaluate are usually multi-layered and complex, and thus require a high degree of expertise regarding both content and methodology.

Qualitative methods are also in demand

The methodological challenge, says Faust, lies in the basic question as to “how a situation might have developed if the developmental intervention had not taken place”. In order to investigate this, his Institute combines quantitative and qualitative methods. “When we carry out an evaluation, it’s not just about identifying the impact, but about finding out why there is an impact”. For this, they need both rigorous impact research and elaborate qualitative methods. “An informed debate won’t play the one against the other”, emphasises Faust.

A few years ago, there was trench warfare between the ‘randomistas’ – the adherents of randomised field experiments as the scientific gold standard – and their critics. But today, the debate about methodology is kept more moderate, explains Faust. “Meanwhile there is greater acceptance of a position that asks more

openly how quantitative and qualitative elements can be combined to form a mix of methods that achieves a maximum of knowledge production”.

Investing more in global knowledge
Isabel Günther, a development economist and the Head of the Center for Development and Cooperation at ETH Zurich, also wants to find out what makes development collaborations effective, and isn’t confining herself to randomised field experiments. Experimental methods are best suited to the micro-level, she says. In order to analyse factors on the macro-level, such as the impact of tax policies, you often need other quantitative procedures. What is essential is that you always identify “what form of development cooperation has an impact in what context, and where it doesn’t”. This fact-based identification of effective interventions by means of scientifically recognised methods is in everyone’s interest. But this does not mean that “every single project or programme has to be evaluated”. Studies on the effectiveness of development aid should not just serve the account-

ability of one organisation, but should rather lead to a continuous improvement of the programmes, insists Günther. This learning process must take place above and beyond the boundaries of individual institutions. “The future lies instead in investing more in global knowledge on poverty alleviation, and in using this knowledge”.

“An informed debate won’t play quantitative against qualitative methods”
Jörg Faust

There are no comparative figures to tell us just how much is spent across the world on evaluating development cooperation. According to Jörg Faust of DEval, not more than one to two percent of the OECD’s development aid money is spent on evaluation. “Given the learning and knowledge needs in fields such as global sustainability and how to deal with fragile states, this surely isn’t too much money”.

Challenging sustainability goals
Both Günther and Faust point to the new UN goals in its 2030 Agenda for Sustainable Development, which has replaced its Millennium Development Goals. The Agenda was adopted by the UN in 2015, and it has seventeen ‘Sustainable Development Goals’ and 169 ‘targets’. In future, development cooperation should no longer merely contribute to poverty alleviation, but should also cushion the consequences of climate change.
This brings new challenges with it – and not just for the assessors. Isabel Günther feels we have to ask the fundamental question as to whether all these challenges can be met using the instruments of development cooperation, when financial resources are in fact being reduced. “Development aid is not the solution to all global problems”.

Theodora Peter is a freelance journalist specialising in development cooperation.

“Development aid is not the solution to all global problems”
Isabel Günther

Effectiveness research in Switzerland – how efficient are health programmes?	on the impact of these health programmes. In the research project “Health Aid: What does it do and how can countries make it more effective”, supported by the SNSF, the sociologists Manfred Max Bergman and Kristen Jafflin of the University of Basel are investigating how health promotion influences health in the recipient countries, and what factors enable some countries to utilise these financial resources more effectively than others.	combine different methods in their work, utilising both quantitative and qualitative components.	a white sheet of paper who are all equally receptive to the most varied of interventions”. But the recipients are “complex social groups with their own cultures, national contexts and living conditions”. What might work in one place won’t necessarily work everywhere. “We can’t design experiments for everything, or carry out impact evaluations everywhere”. The methods being discussed aren’t suitable for all research questions. For example, it is impossible to evaluate just how donor and recipient countries actually work together.
Evidence-based research on the effectiveness of development aid projects and programmes is also becoming more important in Switzerland. One such current evaluation is looking into health promotion. A large amount of the world’s development aid money flows into this sector. Between 2000 and 2010 alone, the funds provided for this have tripled, and today they stand at roughly USD 28 billion a year. However, there have hitherto been only a few studies	Context is everything In an initial phase, countries are identified as being suitable for case studies. Bergman and Jafflin	Bergman and Jafflin are supportive of the move towards more evidence-based development programmes, but they emphasise that the strengths and weaknesses of the different methods must be taken into account. “Impact evaluations and experimental methods are not a panacea in themselves”, they admit. They can also promote a ‘best-practice’ approach, which they both see as problematical because “the recipients of aid programmes are then defined as	



Medical technology from the West can't withstand tropical weather, and spare parts are rare. The consequence of unreliable equipment is a lack of trust – which we can clearly see in the face of the patient being X-rayed. The Swiss photographer Sylvain Liechti took these photos in hospitals in Cameroon in 2015 for an exhibition at EPFL about the challenges of medical technology in the Global South. Several projects at EPFL's

EssentialTech Programmes at the Cooperation & Development Center CODEV are involved in making medical equipment for developing countries. The GlobalDiagnostics project, for example, is working on a digital X-ray machine, while GlobalNeonat is developing a suitable incubator.

The quest for fair research

Western researchers should share more responsibilities with their colleagues from the South. *By Ochieng' Ogodo*

Research has gone global. Finding solutions to problems in developing nations today also means tackling global issues that have an impact on the West, such as climate change and migration. The success of this research will depend on the ability of northern and southern institutions to work together efficiently. "Research capacity in the South has been strengthened over the past 15 years", says Gilles Carbonnier of the Graduate Institute of International and Development Studies in Geneva. Countries like Ghana, Indonesia, Peru, South Africa and many others in the Global South have grown richer, while traditional divides are shifting between the developed and the developing, rich and poor. The international research landscape is changing too.

But inequality still exists at many levels: "In research partnerships we sense the same tensions that are typically embedded in donor-recipient relations in international development cooperation: donors tend to seek to impose their ideas and conditions", says Carbonnier.

The key questions here are: who decides what research projects are to be realised, and who is to benefit from the results? How will those benefits be disseminated, and how can cooperation in a given social system be increased? And finally: who should decide where the money goes?

"Donors tend to seek to impose their ideas and conditions"

Gilles Carbonnier

Deep-seated habits and old, established power relations still play a role in international partnerships, says Carbonnier: "Building fair research partnerships consumes time and resources. There is real pressure to publish research outcomes fast in peer-reviewed - Anglo-Saxon - journals edited in the North. And there is harsh competition for funding". The existing tensions between the drive to recognise academic

excellence and achieving longer-term, capacity-building objectives are at the heart of the North-South research partnership debate. "There is increasing pressure from the partners in the South to engage in fair research partnerships. It is crucial to give greater space to locally produced knowledge and a greater variety of 'knowledge ecologies' - and to accept that contextualisation may lead to outcomes that don't always conform to standard expectations in the north".

Most research in a north-south context contains policy-relevant components, says Laurent Goetschel of the University of Basel, who is president of the Swiss Commission for Research Partnerships with Developing Countries of the Swiss Academy of Sciences. One of the challenges is to get research partnerships functioning despite divergent socio-political and economic contexts.

He who pays, decides

The first question is crucial: who sets the agenda and decides what research should be done? For many years, the decision has been made mostly by the research funders, says Benjamin Apraku Gyampoh, Programme Manager at the Nairobi-based African Academy of Sciences (AAS). For him, research partnerships have biased donor-recipient relations that plague international development cooperation. "There is the infamously wrong perception that the one with the money has all the wisdom and knows how best to use the money". One may have the funds and good intentions, but might not understand the context within which the recipient is working, and might not be willing to learn about the recipient's environment. "Research partners - funders and recipients - must learn from each other about how to develop, re-tool and facilitate systems", he adds. In agricultural research cooperation, it should be the farmers who determine the area of research for funding bodies, says Professor Ngozi Ifeoma Odiaka of the University of Agriculture in Makurdi, Nigeria.

In 2015 the AAS established the Alliance for Accelerating Excellence in Science in

A short history of Swiss collaborative research

1776

The Swiss Johann Wäber (who in English called himself 'John Webber') was appointed the official painter of Captain Cook on his third circumnavigation of the world. Cook had organised the first modern scientific voyages of discovery, but also had concrete economic reasons for his journeys. His task was to identify the best trade routes and improve the plantation economy in the southern hemisphere. Wäber bequeathed his ethnographic collection to the city of Bern before his early death. This became the founding act of the Bern Historical Museum.

🌐 The West didn't succeed in leaving an immediate mark on every society that it 'discovered'. Science in China was more advanced than in the West, for example, and the West's explorers acquired a lot of knowledge that they then brought back home with them.

This amalgam of local and brought-along knowledge - such as came about in medicine, for example - is today called 'pidgin knowledge'. Here, the hierarchy of knowledge does not necessarily reflect the respective power relationships. Thus the British East India Company could only function because its management was able to rely on the knowledge of many local experts.

It was only in the following century that British rule also became dominant in matters of technology and science. In the history of science, this development is discussed as one of the 'tools of empire'. In other words, Western knowledge was not just responsible for dominating the Third World, but also for its resultant underdevelopment.

1815

The General Swiss Society for all the Natural Sciences was founded (the predecessor of today's Swiss Academy of Sciences, SCNAT). Initially, the Society's scope of action was concentrated on Switzerland itself. But there was a growing fascination for the exotic, including among researchers. The 'superior' position adopted by Western observers was paired with a romanticisation of the primitive as a refuge of innocence. The Celebes expeditions in Indonesia were exemplary in this regard. They were organised in the late 19th century by Fritz and Paul

Sarasin, two cousins from Basel who are remembered today primarily as influential natural scientists and ethnologists and as founders of the Swiss national parks. But their expeditions were closely connected to the local colonial overlords and served their interests.

[🌐] The Protestantism of the new colonial powers and a concomitant shift in the image of slavery brought about the notion of promoting 'development', which emerged out of the self-understanding of the supposedly civilised, progressive Europe when compared to 'underdeveloped' societies. This gradually emerged as a new moral precept, that of 'the white man's burden'. Conquered peoples are no longer simply to be exploited: they have to be 'developed'.

1943

Rudolf Geigy – natural scientist, anthropologist and son of a factory owner – founded the Swiss Tropical Institute, which was initially a methodological and thematic smorgasbord, all subsumed under the concept of 'tropics' – although at that time the term remained vague and undefined.

[🌐] After the Second World War, Switzerland was in an uncomfortable political situation. 'Neutrality' became an emotive topic in the international context, and Switzerland was accused of having acted opportunistically in wartime. As a reaction against this, it developed a new foreign policy motto: neutrality and solidarity.

In his inaugural address, President Harry Truman offered a science policy manifesto with his 'Point Four Program', marking the beginning of global development aid. "We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas. [...] For the first time in history, humanity possesses the knowledge and skill to relieve suffering of these people". The motto for this is 'technical assistance'.

1950

Switzerland supported the 'Expanded Program of Technical Assistance' (EPTA) of the United Nations, sending Swiss engineers to work in countries in Asia and Latin America. At the same time, SCNAT established a research station in Adiopodoumé (Cote d'Ivoire), followed five years later by the Swiss Tropical Institute Field Laboratory in

Africa, which is funded by institutions such as the UK's Department for International Development, the Wellcome Trust and the Bill and Melinda Gates Foundation. According to Gyampoh, these funders agree on the need to shift the centre of research decisions and funding from Europe and America to Africa.

"It is crucial to give greater space to locally produced knowledge and a greater variety of 'knowledge ecologies'"

Gilles Carbonnier

The person who is responsible to a donor for a project also needs to have decision-making powers, says Goetschel: "Ideally, this would be a joint responsibility of southern and northern researchers towards a joint funding agency, or of each partner towards his/her funding agency". In practice, however, most of the funding comes from the Global North, so the final decision-making power lies with the Northern partner. Nevertheless, within the governance of a partnership project, rules may and should be developed to assure the Southern partners of the possibility of making joint decisions.

Bringing fairness into research

Another challenge is quantifying the resources invested by recipient organisations whose input goes beyond financing, adds Gympoh. For instance, office space, utilities, salaries and staff benefits are provided to research institutions by African governments, but these are difficult to quantify as research 'input'. As a consequence, funders can get the impression that their partner is contributing nothing, and this can affect their relationship.

Gyampoh believes it is possible to conduct fair research if it is based on the right kind of relationships and partnerships. Funding bodies and researchers on the spot should not wait until after submitting a proposal before engaging in dialogue, but should begin long before this if fair research is to come about.

Who owns the results?

Who is to take the credit for research outcomes achieved jointly by scientists from the Global North and South? This has been a source of some discontent, with scientists

from the South feeling that they are doing all the 'donkey work' while the funding and oversight organisations give all the credit to their Northern collaborators. But the benefit to be derived from research results depends on how those involved define it. To the funder it can mean being acknowledged for providing the money, while for the researcher the benefit can come from publishing the results. To the general community, there can be concrete interventions resulting from the research findings, says Gyampoh.

Data obtained from shared research should belong to all the researchers involved, and made accessible to others on open access as soon as possible, says Goetschel. But sharing this knowledge depends on the kind of results obtained: "Certain types of results are very complex and should be available mainly to the research community", he says.

The Bill and Melinda Gates Foundation is part of the Global Grand Challenges partnership network, which aims to solve some of the most pressing challenges in health and development. "All their grantees and partners must commit to making their research outputs widely available at an affordable price, in sufficient quantity and in a timeframe that provides real and meaningful benefit to those who need it most", says Ayo Ajayi, the director of the Africa Team leading the Gates Foundation's work on policy, advocacy and government relations across Africa. "We continually collect and share data on our progress, reflect on lessons learned, and make course corrections as needed, through ongoing dialogue with our grantees and partners". Published research resulting from their funding is to be promptly and broadly disseminated. They have adopted an open-access policy that enables unrestricted access and re-use of all peer-reviewed, published research that has been funded in whole or in part by the Foundation, including any underlying data sets.

Gyampoh emphasises that research data belongs to everyone. "In fair research, issues of intellectual property must be addressed humanely and with an understanding that what is being done is for the good of all", he says. "Permission should be granted to anyone who wants to use the data ethically for the benefit of humankind. Of course, there must be an acknowledgement of who and what made it possible for the data to become available".

Pélagie Lefebvre is the programme officer of the Canada-based International Development Research Centre (IDRC). He says that his organisation does not prescribe



When the weather is fine, Roger lays out the freshly developed X-rays to dry on the lawn. He's a technician for medical imaging.

Ifakara (Tanzania). The goal was to carry out research on the spot in the Third World with the participation of the local populations. Initially, the approach was paternal, but over time it became more and more of a partnership. Despite this development, institutions of this kind remained confronted with accusations that they were promoting the brain drain from the Third World.

In 1988, SCNAT launched the idea of research partnerships with developing countries. The result was the creation in 1994 of the Commission for Research Partnerships with Developing Countries (KFPE).

[🌐] Over the second half of the 20th century, a significant ideological shift took place in development aid. Doubts grew about 'exporting progress' for the betterment of the developing countries. Garrett Hardin's essay 'The Tragedy of the Commons' in 1968 played a major role in this change of perception. He claimed that the increase in efficiency brought about by the West necessarily promotes the overexploitation of freely available but limited resources.

2001

The National Center of Competence in Research (NCCR) North-South was initiated, also underlining the federal government's emphasis on research partnerships with the Global South. The NCCR brought together researchers from six Swiss research institutions and some 140 partner institutions in Africa, Asia and Latin America in order to work together closely on finding concrete solutions for economic, social and ecological crises.

[🌐] Private foundations are playing an ever-more crucial role as a driving force and as a source of funding for research into the problems of developing countries. This is especially the case in medicine and nutrition. These foundations have been active for some 50 years now – the Basel Foundation for Developing Countries (today the Novartis Foundation) began its work in 1961, the Nestlé Foundation for the Study of Problems of Nutrition in the World in 1966. But their commitment has now attained 'critical mass' and they are creating controversy of their own, raising questions as to whether the main agenda in science policy is today still being set by governments and international organisations.

Roland Fischer is a science journalist in Bern.

precisely how data should be managed, and has seen numerous ways of managing research data in the international collaborations that have been funded. One of the models was a team of researchers who signed an agreement at the onset of the programme, indicating that the country leads would be responsible for collecting the data in their own country, and would be allowed to publish the data that they collected. This ensured that there was no misunderstanding over the ownership of the data. Usually, the IDRC expects that the research conducted will lead to peer-reviewed publications, but it also encourages the researchers it supports to reach out to policymakers and to make their findings accessible to the general public.

"In fair research, issues of intellectual property must be addressed humanely and with an understanding that what is being done is for the good of all"

Apraku Gyampoh

At the University of Agriculture in Makurdi, Odiaka notes that in terms of publicity, most research is published in peer-reviewed journals or in conference proceedings, which limits the scope of dissemination to those who have access to them, or to the few who attend conferences. Sharing both publications and research data is now also a matter of discussion.

Equal partners from the start

In order to apply for IDRC grants, researchers from Canada and developing countries need to come together to develop joint proposals – whether based on existing collaborations or created from scratch, explains Lefebvre. To set up a collaboration on an equal footing, IDRC requires two programme leads: one in Canada and the other in the developing country. Each lead is responsible for his or her own budget, which ensures equality among the lead researchers.

Creating equal partnerships is in the interest of funders and researchers alike. Otherwise, they risk the law courts doing it for them. On 18 July 2014, a landmark ruling by Kenya's industrial court awarded six Kenyan doctors a total of 30 million Kenyan shillings (USD 341,000) in compensation for careers held back by "institutional racism"

in a UK-Kenyan medical research partnership. The doctors, said the court, had faced "systemic discrimination" while working for the Kenya Medical Research Institute – Wellcome Trust Research Programme in Kenya's Kilifi.

According to the ruling, the six were passed over for promotions and grants while they were working for the programme, which was run in partnership with the University of Oxford.

Their lives were disrupted "in terms of career development, contribution to scientific outcomes to the country and in terms of ability to get alternative employment and academic scholarships".

The solution for the future might be found in the past. As Gilles Carbonnier and Tiina Kontinen state in their 2014 EADI Policy Paper 'Academia Meets Development?': "Past experiences can help new actors to avoid falling into the old bias and traps well-known to those who have been active in this field [North-South cooperation] over the past decades".

Ochieng' Ogodo is Sub-Saharan African English Edition Regional Coordinator and News Editor at SciDev.net, a non-profit organisation headquartered in London that publishes news and analysis on science and technology for global development. He is based in Nairobi.



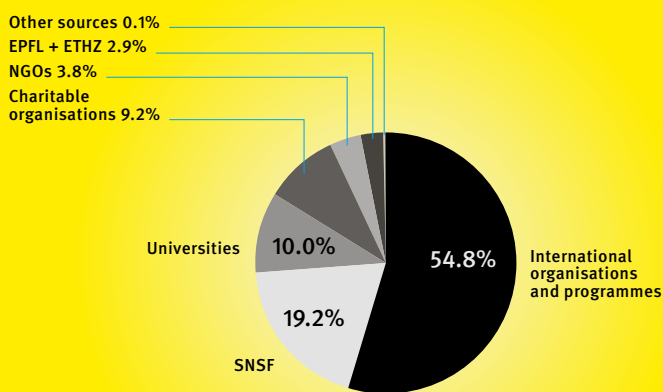
This little girl balances precariously on a chair. The X-ray machine is relatively new, but it's already broken – you can't adjust the height any more.

Key Swiss institutions in development research

In 2015, the Swiss Agency for Development and Cooperation (SDC) funded scientific research to the tune of some CHF 51.3 million in the form of framework credits. This is part of its mandate. The annual benchmark for development research is CHF 50 million. Of this, the biggest amount is invested in international agricultural research. Just how much money flows into development research in Switzerland as a whole is difficult to determine. Besides the SDC, universities, foundations, NGOs and other organisations also invest in this sector.

Most research takes place as part of a programme

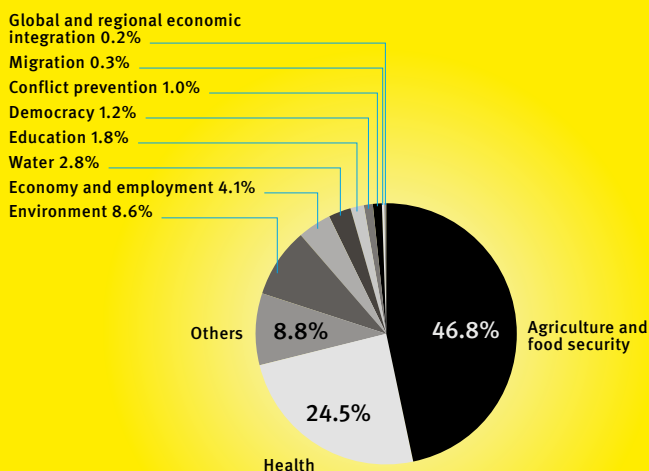
SDC research investment according to recipient category, 2015



The amounts vary each year, according to project cycles.

The lion's share goes to agricultural research

SDC research investment according to overall topics, 2015



r4d programme

In the Swiss Programme for Research on Global Issues for Development (the r4d programme), the Swiss Agency for Development and Cooperation (SDC) and the SNSF together support transnational research partnerships with countries in Africa, Asia and Latin America. The programme replaces traditional North-South research and is intended to provide funds for global sustainable development. Between 2012 and 2022, almost CHF 98 million is being provided. Researchers have to apply for monies from the r4d programme in a competitive process. Up to now, 225 research partners in 41 projects across 42 countries have participated.

Swiss TPH

The Swiss Tropical and Public Health Institute in Basel (Swiss TPH) was founded in 1944. It is recognised across the world as a leading institution in the fields of tropical diseases and public health. In competitive tenders, the TPH regularly competes successfully against consulting companies. At present, the TPH employs over 700 people from more than 60 countries. Just under half of its 2015 expenditure of CHF 76.7 million was spent on research.

Universities

Almost all Swiss universities are involved in development research. The best-known example is the Graduate Institute of International and Development Studies (IHEID) of Geneva, which researches in areas such as peace-building, the environment, trade, migration and health (also under the auspices of the United Nations). Another example is the **International Graduate School North-South (IGS)** at the Center for Development and Environment at the University of Bern, which emerged out of the former National Centre of Competence in Research (NCCR) North-South. Its aim is to establish an international research network. Currently, over 100 people from Asia, Africa, Latin America and Europe are studying at the IGS.

ETHs

The two Federal Institutes of Technology, ETH Zurich and EPFL, are heavily involved in development research. The UNESCO Chair in Technologies for Development has been located at the **Cooperation and Development Center (CODEV)** of EPFL since 2007. Besides engaging in technological innovations for countries in the Global South, such as in the fields of risk reduction and urban planning, EPFL also runs innovative massive open online courses (MOOCs). At ETH Zurich, development research is carried out in the most diverse areas, from the Mobile Health Systems Laboratory to **NADEL**, the Center for Development and Cooperation.

KFPE (Commission)

In Switzerland, the Commission for Research Partnerships with Developing Countries (**KFPE**) is a point of contact for researchers. Its goal is to make a contribution to solving global problems through fair, sustainable research. The KFPE is financed by the SDC, SNSF and SCNAT.

Networks

Several networks are active in development research. For example, there is **SFIAR**, the Swiss Forum for International Agricultural Research, which links interest groups in agricultural research for development. **SNIS**, the Swiss Network for International Studies, has been promoting interdisciplinary research since 2008. And the Development and Cooperation Network of Swiss universities, **SUDAC**, is being built up in answer to the universities' increasing activities in the field of development research. Its goal is to improve the framework conditions for research and teaching in cooperation with partners from the Global South.

Others

There are further important funding organisations such as foundations, some of which have been set up by companies, and the NGOs. It is difficult to estimate how much of their expenditure flows into development research.



Patient dossiers are filed away, but it's almost impossible to find them within a reasonable space of time if they're ever needed. Most hospitals lack functioning computers and IT infrastructure.

“If you can’t laugh, you’ll discover nothing”

Marcel Tanner has more than 35 years of experience in research collaborations with countries in the Global South. He is in no doubt that flexibility, mutual respect and contextual knowledge are essential to his work.

By Marcel Hänggi

Marcel Tanner’s pencil-holder is a component from the gearbox of a Land Rover – it’s a memento of the biggest-ever repair job he had to undertake during his field trips. It was in Tanzania in April 1982, he recalls. He retired at the beginning of this year – in theory, at least. He has moved from the Director’s office in the Swiss Tropical and Public Health Institute in Basel into a smaller office. Art objects testify to his working visits to Africa, Asia and Latin America. But Tanner isn’t content with just babysitting grandchildren. He’s got too much still to do. And he doesn’t wait for our prepared questions to start talking about his research collaborations.

MARCEL TANNER: The founder of our Institute, Rudolf Geigy, began working in Tanzania in 1944. He was busy with ethnological topics, not medicine. But when you see how people live, you soon enough come up against the topic of health. Our approach has always been that we wouldn’t fly in with a research question ready to be answered. Instead, we develop our research questions together with the people on the spot. You need good local knowledge for that. ‘No roots, no fruit’.

Didn’t you have your research questions finalised when you first went to Africa in 1979?

That was a formative experience. We were in Cameroon, looking for a new diagnostic tool for river blindness, which is a parasitic worm disease. We went into the villages where affected people lived, and treated them. Then we realised that these people had very different problems and concerns besides these worms, and that it wasn’t meaningful to deal with just one disease in isolation. After this experience I switched from immunology, which acquires its material in Africa, to epidemiology and public health, which is concerned with system contexts and investigates fundamental principles and solutions through partner-

ships. It’s about engaging in mutual learning to promote change.

Are many researchers open to changing their research questions?

Whenever possible, I send my postgraduate and doctoral students into the field. It doesn’t have to be Africa. If there are parasites in the tap water in the Lützelthal here in the canton of Basel, you still have to work together with all those who are affected. If you send people out and have them work in the field, they will be able to adjust their research questions accordingly. But that’s not always easy when it comes to those giving the money. The people who provide funds usually never get their hands dirty, so they don’t really understand the context.

“Touchy-feely workshops kill off all pleasure in your work”

But Africa isn’t the Lützelthal!

Intercultural collaboration occurs whenever you work together. You don’t need any seminars on interculturalism or any touchy-feely workshops. They just kill off all pleasure in your work. And the pleasure of it is what really counts. If you want to do research, you have to be curious. You have to enjoy sharing your findings with others, and you have to want to achieve something. If you’re in a region with a million inhabitants and you manage to lower child mortality by a third, then you know you’ve achieved something. If you take no joy in things, if you only see the problems and can’t laugh, then you’ll not discover anything. And the joy of it is also what helps you when things don’t go well and you spend a whole day running round to find diesel for the generator in your lab, for example. You learn a lot in such situations.

But learning to find diesel out in the bush isn’t going to help you here in Switzerland.

Oh but it does, because you’ve learnt to help yourself and to deal with operational crises. Today, a lot of Swiss people want to clarify all possible eventualities before they travel to Africa. They even want to know who will provide nappies for their kids – instead of just going there and organising things themselves on the spot.

That all sounds well and good. But there are also cultural difficulties.

How right you are – small ones and big ones! African culture functions by word of mouth, and they don’t always answer straightaway. It’s annoying if I don’t get an answer to my e-mails and I can’t communicate properly. Sometimes you flounder because of the political realities. In Chad, we had a comprehensive programme with the nomads. We were well on the way to setting up an institutional structure. We expected the government to participate, also in financial terms. But then nothing came. Despite eight years of planning with everyone involved, the programme failed to produce results – at least to the extent that had been intended.

Are there enough well-educated people in poor countries?

Education is the biggest problem. We often have students from poor countries who are good in their own subject, but they don’t possess any broad knowledge. You can put this right, but their doctorate will take longer, and the donors have to be prepared to pay the extra. But it’s worth it. Training people well is the biggest impact that you can make – far more important than any journal citation reports or any H index, which are purely for self-glorification purposes.

Science, its methods and cultural codes, emerged in our cultural area. So isn’t any



“It’s not about providing ‘help’,
it’s about learning together”

scientific collaboration asymmetrical from the outset?

Sure. But it depends how you deal with this. Our holy scientific standards are not beyond all doubt either. Just think of the problems we have with peer reviews and our useless publication impact factors... But if you listen to each other, then common codes can emerge. In certain circumstances that can take several generations, which is why a long-term commitment is so important. And it needs respect. If there is no respect, there is no trust. The worst people are the Western consultants who have no local knowledge but always assume they already know everything.

“Training people well is
the biggest impact that you
can make”

Why does Switzerland need a Tropical Institute? Can’t the people affected help themselves?

You have to forget the word ‘help’ straight off. When the official Federal Message on Education, Research and Innovation for 2008-2011 first included research collaboration with developing countries, the critics said: You shouldn’t finance development aid through the research budget. But that’s not what it’s about. If you see that a country has a health budget of CHF 15 per person per year, then you can learn something valuable about our own health system that spends CHF 7,000 per head. It’s not about providing ‘help’, it’s about learning together by comparing and sharing.

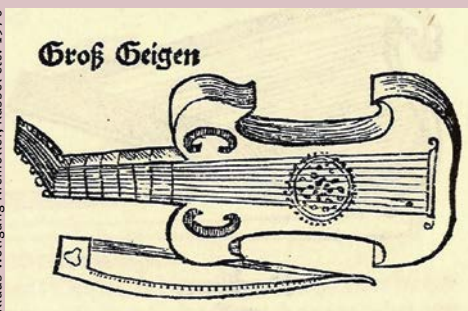
Is your message getting through?

Yes. For example, I recently accompanied a group of members of parliament to Tanzania, from political parties ranging from the Greens to the Conservative Democratic Party (BDP). We visited the projects themselves, we weren’t just in high-level meetings. Even the sceptics were convinced by the purpose of our work and by the value of our partnership approach.

Marcel Hänggi is a freelance science journalist in Zurich.

A charismatic scientist

Marcel Tanner, a professor for epidemiology and medical parasitology at the University of Basel, was the Director of the Swiss Tropical and Public Health Institute (Swiss TPH) in Basel from 1997 to 2015. From 1981 to 1984 he ran the outside facility of the Swiss TPH in Ifakara in Tanzania (today the Ifakara Health Institute). He has been awarded honorary doctorates by the University of Neuchâtel and the University of Brisbane. Since 2016 he has presided over the Swiss Academy of Sciences.



Researchers have used pictures of 'big violins' to retrace their development.

Fiddling big

The Renaissance that began in 15th century Italy, with its classical philosophy, its perspective painting and its courtly music, is often said to have brought sophistication to the harsher cultural climes of northern Europe. But if we look closer, the contours of this picture become somewhat blurred. Thomas Drescher is the director of the Schola Cantorum in Basel. He and his colleagues have been investigating the 'grossgeige' – literally 'big violin' – whose existence in northern Europe in the 16th century is proven in the sources. This string instrument was played in an upright position, clenched between the legs, and later became known as the 'gamba'.

Drescher and his researchers have concluded that the grossgeige was not simply imported from Italy to the north, but in fact underwent its own development on this side of the Alps. One of the areas in which it developed was the region of the Upper Rhine around the Humanist centre in Basel. Even Ulrich Zwingli ordered several gambas to be made in Strasbourg for his private use, despite being otherwise ideologically averse to things sensual.

Researching the early history of string instruments brings its own problems with it, however, for none have survived from before 1500. So researchers have to orient themselves on written traditions – and in particular on the iconography of these instruments. The most important sources are paintings and drawings by the likes of Matthias Grünewald, Hans Baldung Grien, Urs Graf and Albrecht Altdorfer. They show string instruments that are different in appearance from those used at the princely courts of Italy. However, the dynamics of iconography mean that these pictures only have a limited connection to reality, says Drescher. "We have had to translate the images back into the kind of instruments that might really have existed". And of course we can't know how they actually sounded, even if we have an idea of the kind of sounds that are generated by specific constructional characteristics. *Urs Hafner*

Basler Jahrbuch für Historische Musikpraxis
vol. 39, 2015, Amadeus, Winterthur (in press)

Winning bankers

What kind of people become successful traders, making big profits on the stock exchange? The economists Andreas Hefti, Steve Heinke (both from the University of Zurich) and Frédéric Schneider (Yale University) have conducted an experiment to determine their profile. They got some 600 students (male and female) to deal in shares under laboratory conditions. The large number involved meant that they were able to discount any luck factor statistically.

The researchers discerned four character types among their test subjects. The most successful were able to combine analytical thinking with psychological sensitivity. They would sell at the right time, just before a bubble burst, and made the biggest profits.

Thus good traders don't just possess analytical abilities; they don't just think logically or calculate precisely. Their adeptness at putting themselves in the place of others – their 'mentalising' capability – is just as important. "This has thus far escaped the attention of economic theory, but has now been proven empirically", says Andreas Hefti.

The character type who possessed only analytical abilities was less successful. These test subjects generally sold too soon. The biggest losses, however, were made by those who trusted only their instincts, because they sold far too late. The fourth type – those who possessed neither analytical nor psychological abilities and traded unsystematically – arrived back at zero at the end. But at least they didn't lose anything. In other words, it seems that the people who do the least damage on the stock exchange are those who know absolutely nothing at all. *Urs Hafner*

A. Hefti, S. Heinke und F. Schneider: Mental Capabilities, Trading Styles and Asset Market Bubbles. Working paper econwp234, 2016



Successful brokers don't just think rationally. They also rely on gut feeling.



Public opinion in Switzerland changed after the meltdown in the Fukushima reactors.

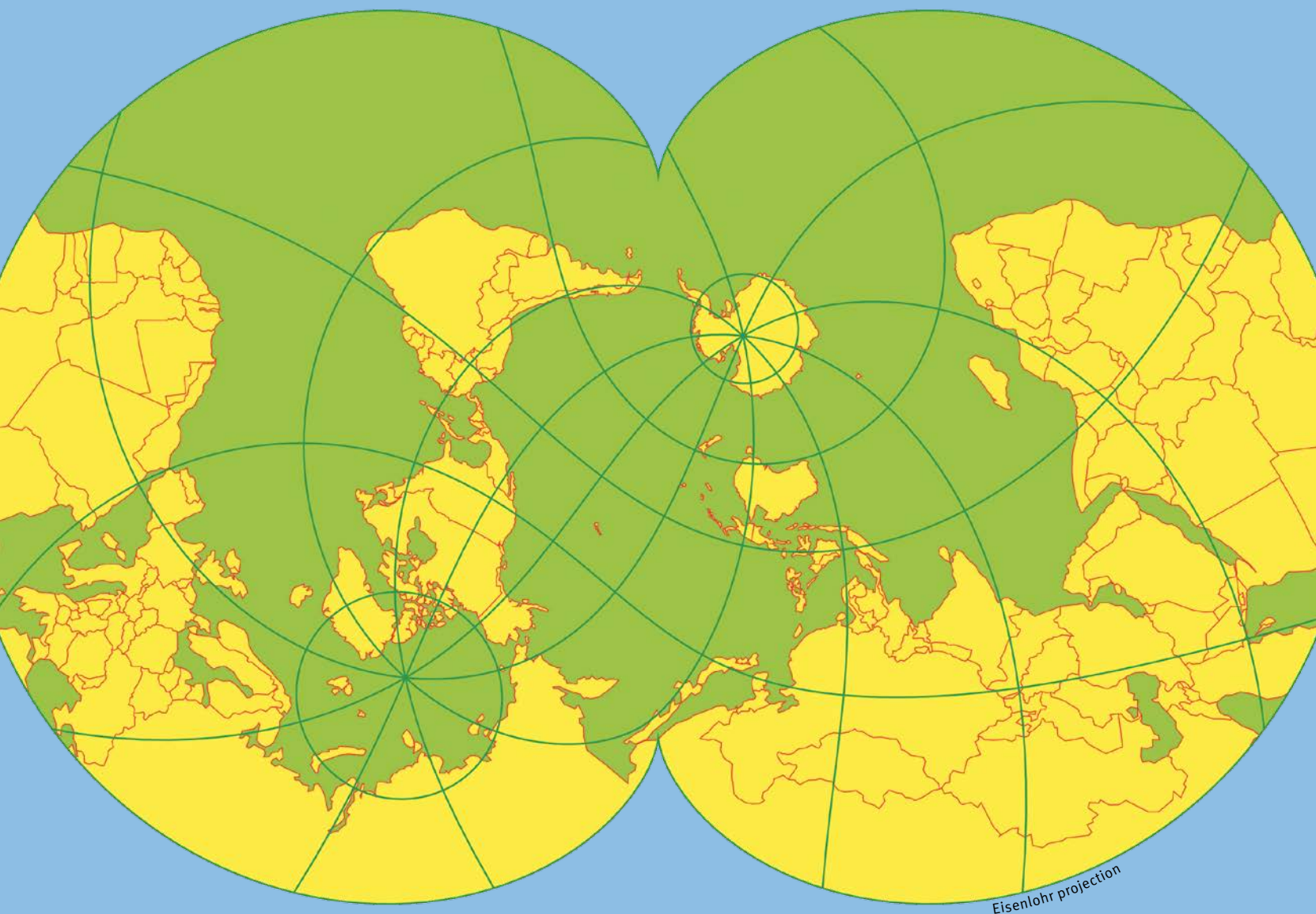
The long-lasting shock waves of Fukushima

Eleventh March 2011 was a day to remember in the history of atomic energy: three reactors at the Fukushima Daiichi Nuclear Power Plant underwent a core meltdown after a severe earthquake and ensuing tsunami.

This accident brought about a world-wide rethink in energy matters. But how great is the scepticism towards nuclear energy, five years later? Researchers from the Institute of Mass Communication and Media Research at the University of Zurich have ascertained that public opinion has barely recovered from the shock of Fukushima. Between 2012 and 2014, they carried out an annual representative telephone survey of people in German and French-speaking Switzerland to ask about their attitudes towards atomic energy. The researchers also wanted to know about the influence of media consumption and about personal opinions on the risks and benefits of atomic energy. They found that the biggest influence on public opinion was people's own cost-benefit evaluations. Their level of education and their degree of media use, however, had no influence on their opinions. "We hadn't expected that", says co-author Silje Kristiansen.

However, the emotional shock after Fukushima has become subdued somewhat in recent years. The population still has a generally negative opinion of atomic energy, but by 2014, more of those interviewed said that its benefits could justify its use. Nevertheless, Kristiansen says that "the atomic accident in Japan had a long-lasting effect on public opinion and on the risk perceptions of the Swiss population". *Astrid Tomczak-Plekawa*

S. Kristiansen et al.: Risk Perception of Nuclear Energy After Fukushima: Stability and Change in Public Opinion in Switzerland. Journal of Public Opinion Research (2016)
doi: 10.1093/ijpor/edw021



Flat Earth

Every map of the world is really a caricature. There are two reasons for this. One is the geometry of the planet itself, and the other is the culture of the cartographer who makes the map. Even the advent of Google has changed nothing. *By Daniel Di Falco*

The year was 2003, the topic North Korea. The English magazine *The Economist* wanted to explain to its readers the danger that Pyongyang's nuclear missiles posed to the world. It did so with a map of the world on which distances were marked by concentric circles. Taepodong-2, the newest missile developed by North Korea, was supposedly able to transport a warhead over 9,000 miles. That meant that all of Asia was in danger, as the map demonstrated - but the West was safe.

Today you can find the *Economist's* map in cartography textbooks as an example of how misleading the use of certain maps can be. The *Economist* had marked out the possible radius of the rockets on a map that was based on the Mercator projection. But this kind of map offers a poor depiction of the curvature of the Earth. In contrast to what the map suggests, the short-

est path from Asia to the USA is not from west to east across the Pacific, but across the Arctic to the north.

Two weeks later, the *Economist* published a corrected version, according to which the Taepodong-2 was able to reach both Europe and the USA. The circles had been made into oval forms - and one could hardly offer a more striking demonstration of what the Mercator projection does to the world: it inflates its proportions, and does so the most towards the Arctic and Antarctic. This is why the same distance appears longer, the closer it is to one of the poles. And this is also why Greenland appears to be as big as Africa on these maps.

An image is not an exact likeness

The Earth is round, but maps are flat. There will never be a perfect solution for projecting a three-dimensional body onto a two-dimensional plane. Every



Mercator projection (conventional)



Mercator projection (re-centred)



Azimuthal equidistant (Australia)



Azimuthal equidistant (Greenland)

Proper proportions

In reality, Greenland is smaller than Australia. Depending on the projection and the geographical midpoint, the relationship between them can appear either incorrectly (left) or correctly (right). These maps were all made using worldmap-generator.

projection brings a certain amount of distortion with it. According to the procedure one uses, the length of a line, the size and form of a surface area or the angle between two lines will change. Some projections are faithful to angles, others to distances or surfaces. That is a matter of applied mathematics – but it isn't the whole story. "Projections don't just create maps of the world: they also communicate ideologies", says Julia Mia Stirnemann. She is a graphic designer and has been looking into the 'constructional and ideological conventions' that we find in maps of the world. Her doctoral thesis deals with graphic design, geography and cultural history, and was part of an interdisciplinary project at the Bern University of the Arts and the University of Bern, entitled 'Mapping Worldmaps'.

Cartographers have been grappling with the problem of projections since Classical times. Today, the different procedures employed "aren't a challenge any more in either mathematical or technical terms",

says Stirnemann. For some time now, attention has been focussed increasingly on the societal baggage that is conveyed by the way the 'earth sciences' look at the world. If maps are not an exact likeness of things as they are, but only images of them, what cultural parameters also flow into their construction? This is what Stirnemann has been investigating.

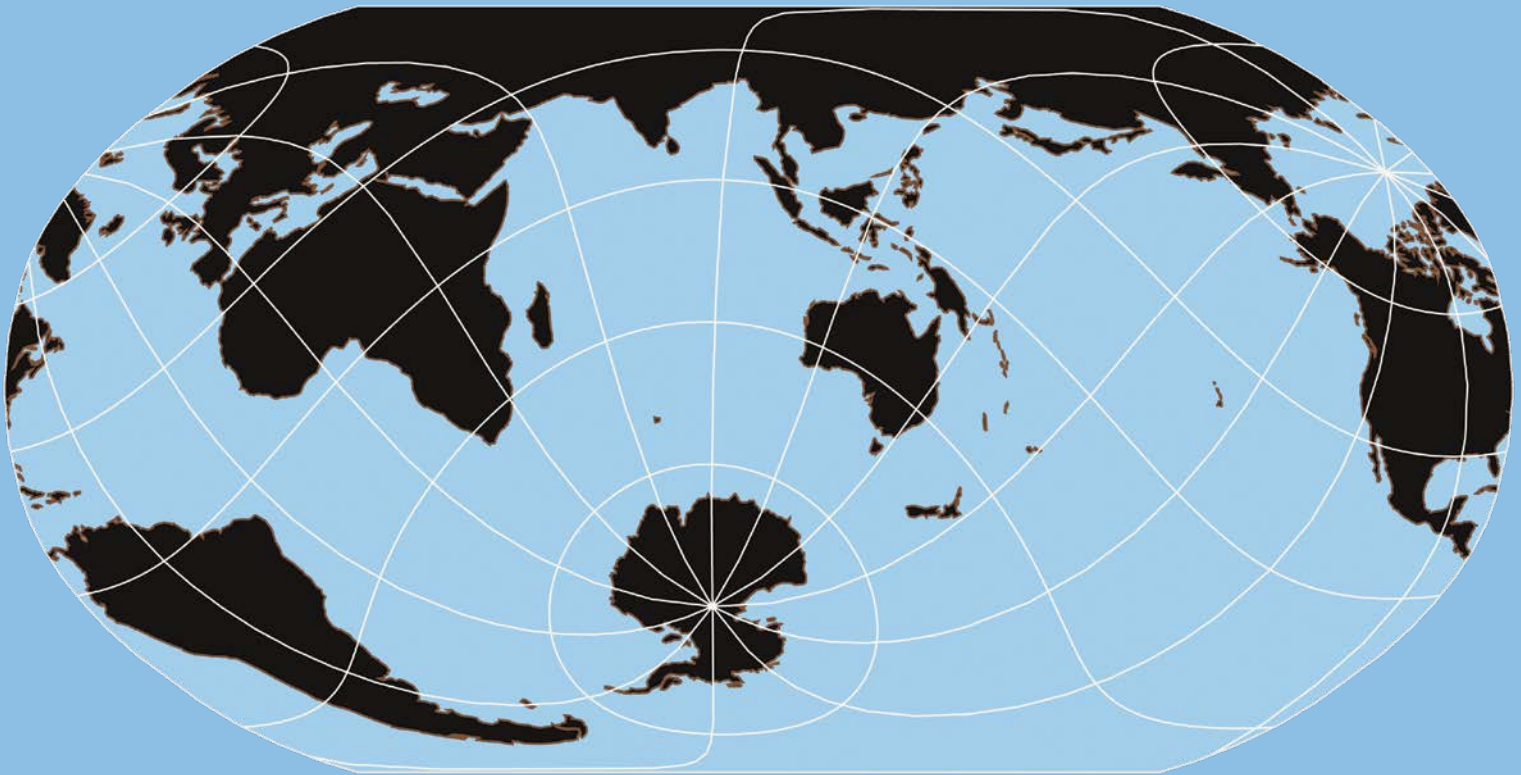
A subjective centre of the world

'About projections' is the title of her study. It reaches back into Classical times to investigate the concepts of Anaximander, Eratosthenes and Ptolemy. Even if their creations were far removed from what we would regard as a usable map today, they are all the more interesting for showing us how our mapped visions of the world are determined by 'paradigmatically predominant explanatory models' of the things and people in our global order. The symmetries of the early Greek maps, for example, reveal the teachings of their natural philosophy, and while

their 'centres' were situated in Delphi or Alexandria – which were the centres of political and cultural power at the time – their midpoint later shifted towards Jerusalem. The centre of the map always signified the centre of the world; it was from this starting point that the Earth was conceived, and its boundaries defined and drawn.

No world map is possible without distortions – but which areas are affected depends on cultural and political power.

This was just as true for the Middle Ages in Christendom. It was no longer the geometry of the world, but God who kept the world together. Occasionally, it was even Christ or the Cross that provided the form



Robinson projection (Indian Ocean)



Robinson projection (Europe)



Robinson projection (North Pole)

Distorting perspectives

Using the same projection three times, but with three different midpoints, produces unusual views of our planet.

of maps. And the North wasn't at the top, but the East - because people thought that's where paradise lay. Maps were less an aid to spatial orientation than a demonstration of God's global reach. They comprised the places relevant to the Christian history of salvation and other biblical motives. This gave maps a temporal dimension besides their spatial aspect.

Maths hides vantage points

It was in this manner that cultural perspectives inserted themselves between the world and our images of it. A map is more than just "a conventional arrangement of data", writes the geographer Jacques Lévy in his article 'A Cartographic Turn?'. Lévy works at EPFL and is investigating the origins and the future of cartography, which is really also a 'language' - albeit a language that has, since the Renaissance, increasingly insisted that it is objective and absolute. In the course of becoming a 'science', the art of mapping oriented itself on

standardised mathematical models. This allowed it to hide its metaphorical vantage point - though hiding it didn't make it simply disappear.

During the Cold War, cartographers in both the East and the West used the Mercator projection to have the Soviet Union appear particularly large - as a demonstration of its power and of its supposed threat to the rest of the world, respectively. Setting the prime meridian in Greenwich and the traditional position of Europe at the centre of a map also helped to emphasise the East-West division of the world, along with the respective pretensions to power of each side.

It was just such entanglements with politics and projections, hegemony and cartography that the 'radical geography' of the 1970s aimed to overcome. And it is not a little ironic when we consider just where this democratisation and pluralism of map-making has brought us. In the digital era, the products of Google are available everywhere, but this means they have

also become universal norms. There is now a new imperialism to criticise - one that is no longer concerned with controlling territories, but with controlling data about these territories.

Elastic worldviews

Above and beyond this, Stirnemann also demonstrates how Google's designs of the world support the continued relevance of the eurocentrism that was thought to have been overcome. In Google Maps, a user can choose his or her standpoint and focus, but this does not change the fact that the whole world is oriented around Europe and is constructed with it as its starting point. The basic map is based on a traditional Mercator projection and perpetuates its notorious distortions. So whoever uses Google Maps in Africa will still be standing on a continent that is no bigger than Greenland.

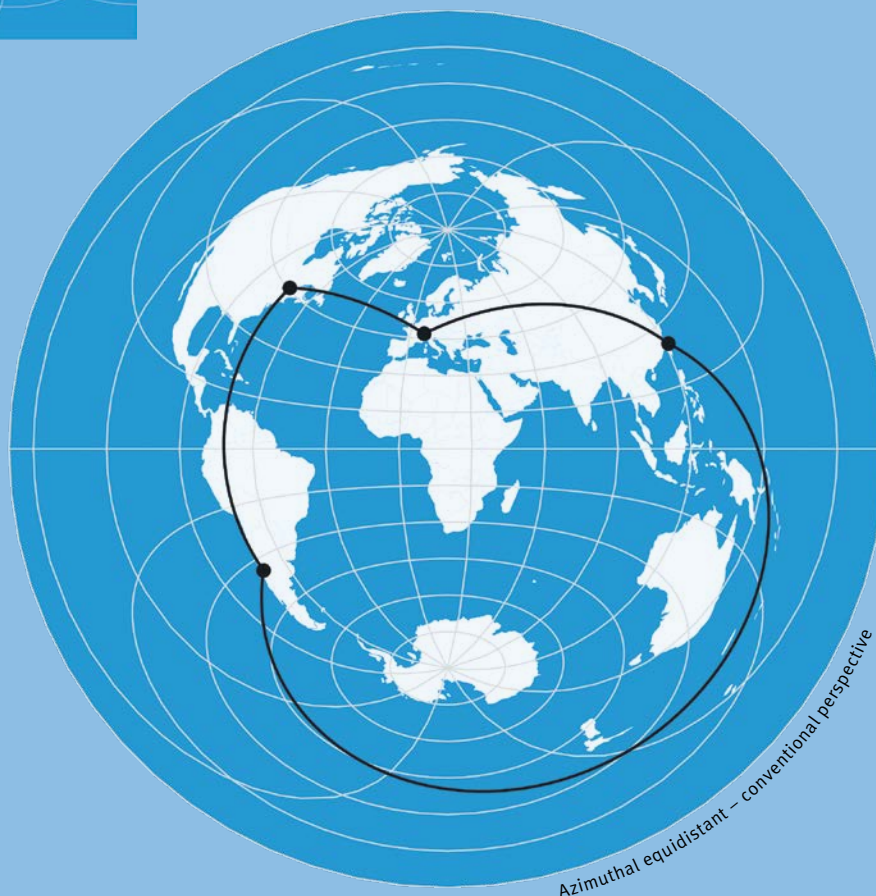
On www.worldmapgenerator.com, we can see just how much our image of the world can really change if we shift the



Miller perspective: Santiago

“A map is a conventional arrangement of data as well as a language”

Jacques Lévy



Our eyes deceive us

In the usual view (left), the distance from Bern to Montreal seems longer than the distance from Montreal to Santiago de Chile. In fact, the latter distance is almost two thousand miles longer. The round depiction takes the curvature of the Earth into consideration.

midpoint of a map, and thereby also shift our perspective of the world. It is an app that Stirnemann has developed with a team at the Bern University of the Arts. It lets you generate “unconventional world maps” in a playful fashion; different projections can be combined with freely selectable midpoints. The result is a series of worlds that barely look anything like the one to which we are accustomed, even though they are constructed using the same mathematical rules and are no less ‘true’. No world map is possible without distortions of some kind - but which areas are affected by such distortions (and which areas aren’t) depends on where the cultural and political power lies.

Can art offer a solution?

We could describe such an approach as ‘deconstruction’, as Stirnemann does - taking her cue from the cartographer John Brian Harley (‘Deconstructing the map’, 1989). Or we could see it as a practical contribution to

a theory of relativity of cartography. Either way, it fits a current trend in research that sees Lévy’s ‘cartographic turn’ on the horizon. And while cartography might owe its scientific status and its technical efficiency to its mathematical formalisation, says Lévy in his article, it paid for this development by an ‘impoverishment’ of its language, its creativity and its expressive power. Today, digital surveys have dramatically developed our view of the world, almost without any participation on the part of academic cartographers. This is why Lévy focusses on pre-Modern times, when maps were still able to convey different worldviews and measurements at the same time. He is also investigating non-Euclidian geometries and aspects of both time and space. In these approaches, as also in non-European map concepts and in contemporary art, Lévy discerns an ‘innovative logic’ that could free cartography from the corset it wears today.

The path could be a long one. Because while maps are primarily a means of ori-

entation, the viewing habits and cultural norms that they incorporate are tenacious in nature. The “most striking event in the history of images of the world”, according to the art historian Horst Bredekamp, was the photo that the crew of Apollo 17 took on 7 December 1972. It shows the Earth as a blue sphere with swirling white clouds above Africa and the Antarctic. This image achieved iconic status, but only after NASA turned it on its head to make it recognisable. The original image had the South Pole at the top. Unlike our maps that shape the way we see the world, the Universe knows neither top nor bottom.

Daniel Di Falco is a historian and a journalist at Der Bund in Bern.

“In Switzerland, the history of decolonisation is less politicised than it is elsewhere”

Alexander Keese is a specialist in African history and is being awarded the 2016 National Latsis Prize for his analyses of decolonisation.

By Benjamin Keller

In his office, Alexander Keese's research is on display in the form of a statue from Angola and a series of photos of the archipelago of Sao Tomé and Príncipe – representing two former Portuguese colonies in Africa. Keese is a specialist in the comparative history of decolonisation in western and central Africa, and forced labour and ethnic mobilisation during conflicts. He is a recipient of an SNSF bursary and has worked in the General History Department of the University of Geneva since 2015. He is about to receive the National Latsis Prize. Keese is a 39-year-old German national and he accepted Horizons' invitation to an interview in French, one of the six languages that he speaks.

How did you react to the news?

I was completely surprised. I thought it was very rare to award the prize to a historian. Of course, global history is fashionable these days, but it's not often in the running for a prize like this one. What's more is that my projects tend to start out from a very vast problem and only later identify more specific questions. For me, this is the best approach, but in many countries there is pressure to provide responses before even having carried out research... I think it is also quite unusual to have been named without having spent my entire career in Switzerland.

What is the basis for your work?

There are three pillars: the history of decolonisation, forced labour and issues of ethnicity. On ethnicity, for example – something which is often used to explain everything that happens in Africa – my work has shown a relative importance. In other words, we might say that the more stable the situation is, the less this is a factor.

And what about the other two pillars?

I've looked at the integration of African elites in the decolonisation process. There I found they were almost never appointed to positions of real responsibility in the colonial administration. Instead they were integrated informally, taking up posts such as counsellors. Their growing influence led them to call for independence, a move



Valérie Chételat

Alexander Keese's research has shown that “African elites were almost never appointed to positions of real responsibility in the colonial administration. They were integrated informally”.

which eventually led to decolonisation... With regard to forced labour, I found evidence of a return to these practices by colonial states in brutal forms between the end of the 19th century and the first half of the 20th century, a period otherwise known for its good labour practices.

The history of decolonisation has been studied on the political level to a great extent; however, you are one of the few who look at the social situations of populations. Why is that?

It's difficult to access the archives. And when it comes to witnesses, they are either old or dead. One other problem is the highly politicised nature of the topic. Often, the current political climate will cause versions of the facts to vary. The past gets reinterpreted.

And how do you work?

Historians generally have two approaches: carrying out interviews on the ground or using archives. In my current work, I am relying more on the second method. These involve classical sources such as administrative documents, but they are not easy to find and are often in a shocking state.

How do you feel in Geneva?

I'm happy to be in one of the key places of global history, rubbing shoulders with

specialists from every part of the world. Then there's the fact that decolonisation is much less politicised in Switzerland than elsewhere in Europe. It's much easier to talk about it. Switzerland is also very interesting because it is open to the European languages spoken in Africa.

Benjamin Keller is a freelance journalist and currently lives in Cairo.

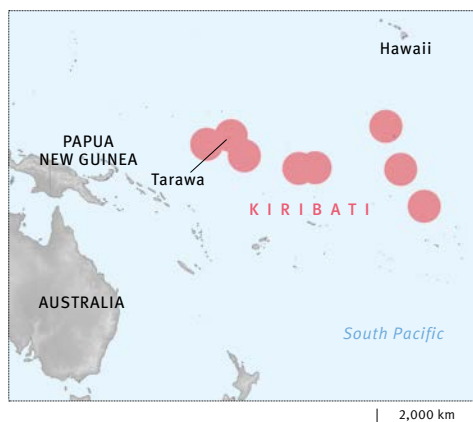
Video interview and pictures of his research: www.snsf.ch/latsis and www.fns.ch/latsis

The 2016 National Latsis prize

Since 1983 the Latsis Prize has been awarded by the SNSF, under the auspices of the International Latsis Foundation in Geneva. The prize money is CHF 100,000 and goes to a researcher under 40 years old whose work is considered exceptional and who conducts research in Switzerland. The 2016 recipient Alexander Keese was born in Hanover in 1977. He did his doctoral degree at the University of Freiburg im Breisgau and his post-doctoral habilitation at the University of Bern. He also conducted research at the University of Porto and at the Humboldt University of Berlin before coming to Geneva in 2015. He is married.

English under swaying palms

Languages are constantly changing. The sociolinguist Tobias Leonhardt from the University of Bern, born in 1989, has been in the South Seas to investigate what drives these changes.



“Kiribati is a long way away from my university in Bern – over 9,000 miles away as the crow flies. Though you can’t actually fly straight there, as you have to change planes several times, including in Australia. Air Nauru then brings you to an airport on the Tarawa Atoll. When I visited there in 2015, I travelled the last few miles in a canoe. I then spent three months with Amon, Tekinati and their children in their huts made out of palm and pandanus leaves. I call them my Kiribati family – they were so friendly and open. It didn’t bother me that they didn’t have any running water and only occasionally had electricity. In compensation, I joined in the ‘toddy-cutting’ among the coconut palm trees every morning and evening. That’s what they call the procedure of cutting open the fruit in order to get the sweet-and-sour palm juice.

Amon and Tekinati speak English and were able to organise contacts with local people for me. I’m researching into how English has developed in this group

of islands, both before and after the time when it was a British colony – it has been an independent state since 1979. You might think that it couldn’t be a problem to find English-speaking people in a country where English is the second official language and where school students are never allowed to speak their mother tongue on school grounds. But in fact most of them can only say a few sentences, such as: “Where are you going?”. But this actually means something along the lines of “How are you?”

From a South Sea paradise to an office in Bern

Hardly any foreigners come to Kiribati. There are few amenities, and there’s no organised beach fun. If you’re European, people notice that you’re something exotic by the time you leave the main town of South Tarawa, if not before. The children cry “I-Matang, I-Matang”, which means “White man, white man!”. But everyone is open and happy to meet you. You’re con-



People can still live on the Tawara Atoll of Kiribati (left) and their children can play football without a care in the world (top). But if the sea levels continue to rise, their language will be a more lasting relic of English colonial rule than their cannon (bottom).

Photos: Tobias Leonhardt

stantly getting invited to eat with people you've never seen before. So it was easy to get talking to people, and this is ultimately how I found my English speakers.

As a sociolinguist I investigate the impact of culture and society on language. This is why I tried to have conversations that were as natural as possible. For this, I used unobtrusive microphones that I was able to attach to me and to my conversation partner. We then simply talked about whatever took our fancy. I told people about the seasons and the mountains in Switzerland. And the I-Kiribati - that's what the inhabitants of Kiribati are called - told me of their lives in a society where money plays a very different role from here, where hardly anyone has an Internet connection, and where people on the whole get their food from plants or from the sea. That was incredibly interesting.

But working on my recorded material back home in Switzerland is not as colourful. Above all, I'm busy analysing how the

pronunciation of Kiribati English differs from standardised forms. You have to listen to everything a thousand times in order to transcribe it properly and to extract the data from it. All the same, I already have initial findings. For example, there is an interesting pronunciation of the English consonant pairs p/b, t/d and k/g, in which the first in each pair is unvoiced and the last is voiced, such as in pea/bee, tea/dear or key/gear. In Kiribati there is in each case just one consonant that is situated somewhere between these pairs. Some people - usually the younger ones - manage to get the difference right in English. Others - mostly older people - don't.

Language and climate change

My research is one small jigsaw piece in a global description of the varieties of English found in Micronesia. I am working with other doctoral students who are gathering linguistic data on four other islands in Micronesia, also about grammar,

accents and for a dictionary. In this manner we are documenting the linguistic situation in the whole region. This is important, not least because Kiribati is already under high threat from the rise of the sea levels in the region. According to some prognoses, the islands could already be completely covered in just 50 years. So one sociolinguistic question would be how this threat impacts on the language. Could it be that young people learn better English because they know that they will at some point have to emigrate to Australia or New Zealand? Perhaps our studies can at least help to awaken an awareness of an otherwise very little-known part of the Earth, and can help to develop better textbooks.

Recorded by Christian Weber.

Controversial inheritance

Our experiences leave behind epigenetic traces in our genetic material. Just how big an impact this has on our descendants remains a matter of debate.

By Ori Schipper

An ideological dispute is taking place in biology. And it's about a big topic that's central to everything: heredity. In his epoch-making book *On the Origin of Species* of 1859, Darwin wrote of the reigning ignorance about how differences between individuals come about. It was only with 'modern evolutionary synthesis' in the 1940s that people became convinced that heredity functions through genetics - in other words, that the characteristics of living creatures are passed on to the next generations through their genetic substance, DNA.

This perspective was helpful in providing a focus for research in the ensuing decades, which brought about extraordinary discoveries. As a result, many aspects of the form and function of living creatures can now be explained. But already in the 1950s, different observations called into question the seemingly exclusive control of the genes. For example, maize kernels can have different colours even if their DNA sequence is identical.

Plants remember aridity

Further investigations brought to light the fact that when individuals with identical genetic material have a different outward appearance, this can be traced back to different degrees of activity on the part of the genes. Whether a particular section of DNA is active or not - i.e., whether it is read - depends to a decisive degree on how densely packed the DNA is.

This packing density is influenced by several so-called epigenetic mechanisms.

They form a complex machinery that can affix or detach tiny chemical attachments to the DNA. Here, the rule applies that the tighter packed the DNA, the more difficult it is to read - and this means that a particular gene will be more inactive.

“Epigenetics could explain a familial predisposition to mental illnesses”

Isabelle Mansuy

Living creatures can adjust to a volatile environment by steering their epigenetic mechanisms. In this manner, for example, the epigenetic machinery can ensure that plants can deal better with a hot or arid climate if it at some point they already had to live through a similar situation. So in this sense, the epigenetic markings in the genetic material form a kind of 'stress memory' of the plants. This much is today a matter of consensus among biologists.

Doubts on heredity over generations

Several studies, however, suggest that the descendants of stressed plants are also better prepared against the dangers already faced by their ancestors. “However, these studies are a matter of controversial debate”, says Ueli Grossniklaus, the director of the Department of Plant and Microbial Biology at the University of Zurich. Like many other epigeneticists who are involved in

deciphering these mechanisms, he believes that, “since the evidence is patchy, we can't yet say to what degree acquired characteristics can be transmitted in stable form over several generations”. So it still remains to be proven whether epigenetics actually brings organisms long-lasting advantages and thus plays a role in evolution. It's an attractive idea, thinks Grossniklaus, but it's still to be demonstrated.

It's not just in plants that results on the heredity of epigenetic markings are causing a stir - the same is true in mice. In order to investigate the possible long-term effects of severe childhood trauma, for example, the research group led by Isabelle Mansuy, a professor of neuro-epigenetics at the University of Zurich and ETH Zurich, has been taking mouse offspring away from their mothers for three hours each day, just a few days after being born.

Male mice pass on trauma

When they reach adulthood, the mice subjected to a difficult infancy displayed behavioural disorders and the corresponding chemical traces in their genetic material. For example, when compared with control mice who were always allowed to remain with their mothers, the traumatised mice spent significantly more time in the brightly lit section of their cage than in the dark section.

The behaviour of these mice has allowed the researchers to deduce that the traumatised animals showed symptoms of depression and yet, at the same time, less fear. “They seem to seek danger, such as we of-



Carl Linnaeus was puzzled back in 1742 when he compared genuine toadflax (*Linaria vulgaris*) ...



... with its aberration (*peloria*). The difference between them was explained in 1999 as a single epigenetic mutation.

Photos: John Innes Centre

ten observe in US war veterans who suffer from post-traumatic stress", says Mansuy.

Astonishingly, Mansuy's research team has observed the same behavioural abnormalities in the offspring of these traumatised male mice - even where the young mice were never separated from their non-traumatised mothers. Obviously, the sperm contains an epigenetic signal that is also able to codetermine the gene activity of their offspring.

Cancelling out epigenetic memories

This is precisely what causes the greatest unease among many experts. They argue that the genetic material is subjected to epigenetic reprogramming to such a high degree during the maturation of the sperm, and afterwards in the fertilised ovum, that this erases most of the epigenetic markings acquired during the mouse's life.

"I agree", says Mansuy, "but it is also proven that some markings survive this reprogramming". There are also other epigenetic mechanisms. In addition to the hereditary material from DNA, sperm also contains a complex collection of small and micro-RNA molecules that can intervene in the epigenetic mechanism, thereby

playing an important role in the intergenerational regulation of gene activity.

Mansuy believes that her experiments, along with those carried out by others, have served to prove at least in principle the existence of epigenetic inheritance mechanisms. She also reckons that epigenetics may in part explain why there is a familial predisposition to many complex illnesses such as diabetes, cancer and mental illness, even though these inheritance patterns cannot be explained by classical genetics.

"The evidence for epigenetic inheritance is patchy"

Ueli Grossniklaus

In comparison with other genetic mutations, epimutations occur roughly a thousand times more often, as Detlef Weigel's group at the Max Planck Institute for Developmental Biology showed in their 2011 investigation of 30 generations of thale cress (*Arabidopsis thaliana*).

Furthermore, epimutations are fundamentally reversible. Perhaps this is why

epigenetic traces in our genetic material are transmitted to the next generation, and sometimes also to the generation after that, but then usually disappear again. It is probably just this transitory and uncertain characteristic that nurtures the current disputes - and will probably continue to nurture them until biology has finally understood in full the complex epigenetic machinery of inheritance.

Ori Schipper works for Krebsliga Schweiz and as a freelance science journalist.

Anti-viral rapid reaction force

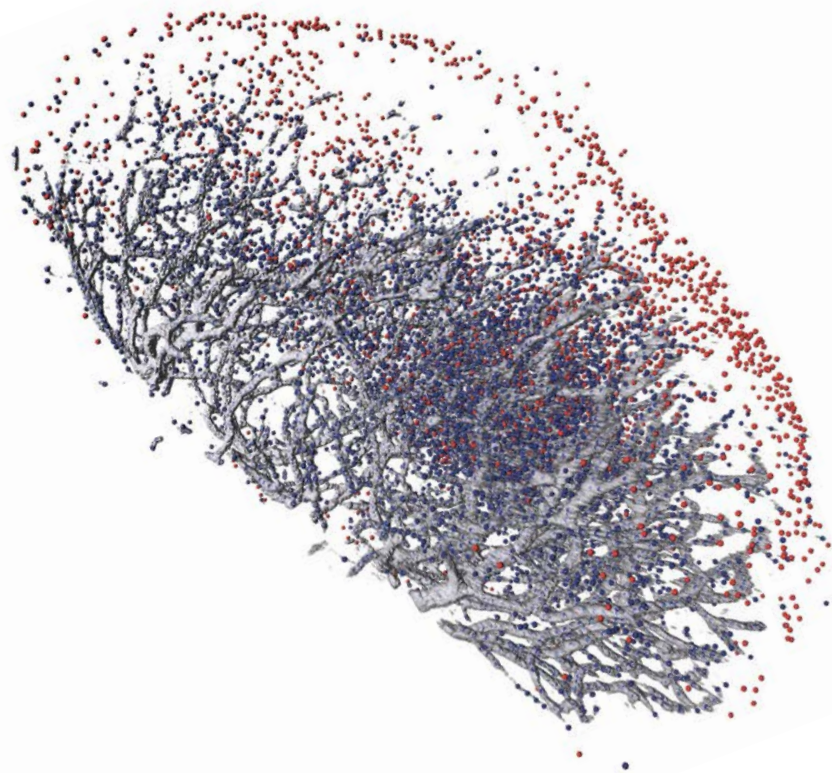
The textbooks tell us that killer cells have to match their antigens exactly if they're to fulfil their task. Researchers in Bern, however, have also found that loosely attached white blood corpuscles also play a role in the immune system. *By Karin Holtricher*

After host cells have been attacked by a virus, they present parts of the pathogen on their surface. Thanks to these virus components, the killer cells patrolling in the body (CD8⁺ T lymphocytes) can recognise the infected cells and kill them, thereby preventing the virus from spreading further.

Until now, the orthodoxy was that killer cells were the primary component in the body's immune response. These so-called high-affinity killer cells attach themselves firmly to the antigens presented on the surface of the host cells. Then, one or two weeks after infection, we only find high-affinity killer cells in the blood. The low-affinity killer cells that carry fewer matching receptors have always been believed to be rejects from the production of these white blood corpuscles.

However, Jens Stein and his colleagues at the University of Bern have for the past four years been busy investigating the behaviour of the low-affinity killer cells, and they now doubt the current wisdom. They have found indications that these less precise cells also make a contribution to the immune response. After a brief activation phase, they launch an initial, quick attack on an intruder while high-affinity killer cells are proliferating in massive numbers in order to attack the pathogen in a mighty, second wave. "This is still just a hypothesis, but our experiments suggest that it is the case", says Stein.

The researchers injected killer cells into test mice that had been provided with a receptor against a specific antigen such as might come from a virus. In addition, the animals were given dendritic cells that present assorted antigens to the killer cells, activating them and thus prompting an immune response. Using a special two-photon microscope, the researchers followed what happened in the lymph nodes of the anaesthetised mice. Stein and his colleagues developed this method specifically for this type of experiment, and it enabled them to determine precisely where and when the cells interacted with each other.



The work of the killer cells is revealed here using a 3D reconstruction of a lymph node. As soon as cells enter with the correct antigen (red), they are destroyed. Those without the antigen (blue) are spared. Blood vessels are shown in grey. Photo: Aleksandra J. Ozga

Quicker, but less thorough

"To our surprise, all the killer cells reacted with the dendritic cells – regardless of which peptide the dendritic cells presented", says Stein. "So all the T cells prepare themselves for their role as killer cells. They initiated the differentiation and began to proliferate".

"High-affinity killer cells come into play later, but are all the more numerous"

Jens Stein

However, there was a major difference among these encounters: if there was a strong link between dendritic cells and the killer cells, the molecular dialogue lasted longer. If dendritic cells had the lesser matching version of the molecule on their surface, and if the link was looser, then the T cells were activated and were prompted to begin proliferating. But these T cells abandoned their contact with the dendritic cells very quickly and then migrated to the exits of the lymph nodes in order to

go virus-hunting. At the same time, these low-affinity cells acquired their killer function more quickly than the cells whose receptors were highly suited to the peptide on offer. The high-affinity T cells, meanwhile, did not remain very long in contact with the dendritic cells and proliferated; their daughter cells were also activated and made to proliferate.

"We interpret this and other data as meaning that low-affinity cells are a small, rapid-response group", says Stein. "High-affinity killer cells come into play later, but are all the more numerous, presumably more accurate and quite possibly more effective". At least, this was the case in the mice. There has as yet been no verification of this in human tests.

Karin Holtricher is a science journalist in Neu-Ulm.

A. J. Ozga et al.: pMHC affinity controls duration of CD8⁺ T cell – DC interactions and imprints timing of effector differentiation versus expansion. *The Journal of Experimental Medicine* (2016)

Getting to the heart of listening

It's the cornerstone of any medical examination: the doctor leans forward, applies the stethoscope and listens to the heart of his or her patient with a look of deep concentration. The quality of cardiac auscultation among young doctors is slipping, however. A recent study on the issue shows that a good diagnosis has to consider both the heartbeat sound and its meaning.

"My research group has been studying different aspects of non-verbal auditory recognition for more than 10 years", says Stéphanie Clarke of the Lausanne University Hospital (CHUV). "There's a relatively good understanding of what happens in simple sound-discrimination processes, such as recognising a dog bark. We have been looking into what happens when it's a more complex process".

Eleven medical students were first trained, then asked to identify abnormal cardiac sounds. The individual sounds were difficult to tell apart and, by using ECG measurements, it was possible to identify the regions of the brain active in the task. "We had expected the auditory cortex to play a fundamental role in this kind of recognition", says Clarke. "But our results showed that the best diagnosis was obtained when other parts of the brain were active, notably those involved in attributing meaning to things we see or hear".

The results show that tasks of very complex identification necessitate attributing meaning rapidly to an auditory stimulus. Training should therefore place emphasis not on the hearing alone, but also on the meaning of sounds, particularly when they are difficult to recognise. *Marie-Christine Petit-Pierre*

R. De Meo et al.: What makes medical students better listeners? *Current Biology* (2016)



Listening well means understanding well.

Thomas Roder



The plant has to divide up its defences to fight the cotton leafworm and other enemies.

Surgical strikes on maize

When attacked by the cotton-leaf worm caterpillar, the maize plant faces a dilemma. It can choose to defend itself by producing elements of 1,4-benzoxazin-3-ones (or BXs) which work as an insecticide. But it needs a precursor to make them, and when its reserves are used up, they are no longer available to help the plant defend itself against attack by other pests such as aphids. Researchers at the universities of Bern and Neuchâtel have discovered that the defensive reaction of maize is highly localised, with the toxin being produced no more than one centimetre from the site of the attack.

"BXs are used parsimoniously, preserving the chemical arsenal in case of attack by other herbivores", says Matthias Erb of the University of Bern. The reaction continues for a week following the attack. "To a certain extent the plant predicts the return of the predator or the arrival of a new caterpillar", he says. "Mutant plants deficient in the BX gene are incapable of a normal defence, which underlines the link between the metabolite and resistance to other herbivores. The research has also shown the defensive capability of BXs *in vivo*, as the growth of caterpillars was greatly reduced in response to them", says Daniel Maag, a doctoral student at the University of Neuchâtel. The endgame of this research is a better understanding of the immune system of plants and therefore an aid in the fight against crop pests. *Fleur Daugey*

D. Maag et al.: Highly localised and persistent induction of Bx1-dependent herbivore resistance factors in maize. *The Plant Journal* (2016)

Non-diagnosed delusional disorders

The earlier psychotic illnesses are diagnosed, the better the chances are of healing them. But many of those who suffer from psychoses such as hallucinations or schizophrenia only begin treatment late.

Just how many people in the general population suffer from undiagnosed psychoses is something researchers at the Bern University Hospital of Child and Adolescent Psychiatry have now investigated in detail for the first time. To this end, a team of specially trained psychologists interviewed almost 2,700 people chosen at random from the age group most at risk, namely between 16 and 40 years old. Telephone interviews were carried out according to a set of questions that is also utilised in clinical practice to diagnose psychoses. As a preliminary study showed, this method provides almost the same results as a personal conversation.

Psychosis was diagnosed in 1.5% of the participants - but only roughly half of them were already being treated. It was people with hallucinations in particular who more rarely sought professional help. "Schizophrenia rapidly leads to conspicuous losses in overall performance, such as incoherent speech", explains Frauke Schultze-Lutter, who is heading up the study. "People with delusional disorders, however, are often unaffected in their everyday life and are convinced that all is well with them".

Schultze-Lutter estimates that the number of people suffering from delusional disorders is roughly twice as high as previously assumed. For this reason, she argues that the general population should be better informed about the symptoms of nascent psychosis. This would enable them to be diagnosed at an early stage, which would in turn increase their chances of being treated successfully. *Yvonne Vahlensieck*

C. Michel et al.: Demographic and clinical characteristics of diagnosed and non-diagnosed psychotic disorders in the community. *Early Intervention in Psychiatry* (2016)



Non-diagnosed mental problems are discovered by means of targeted questions.

Sculpting robots

For mechanical engineer Jamie Paik, the most beautiful art is functional, too. Her passions: designing elegant and nimble ‘soft’ robots, and creating devices that are indispensable for everyday life.

By Celia Luterbacher



Jamie Paik has always been interested in art. Inspired by her painter mother, she discovered as a child a love of sculpture and the process of shaping materials. So, she became a mechanical engineer. "I wanted to study fine arts, but my parents said that was a hobby, and not a profession!", she says, laughing. "So the closest thing that was acceptable was mechanical engineering, because you create something out of nothing".

In 2012, Paik founded the Reconfigurable Robotics Lab at EPFL. Her specialty is soft robots, devices that can rapidly alter their shape and movement in response to changing environments and situations. One of her lab's primary research projects is the 'origami robot': a Post-It note-sized sheet of 3D-printed tiles connected by flexible joints and embedded copper circuits, which folds itself into shapes and could have applications in tasks ranging from communications to search-and-rescue missions. But Paik says her research is inspired more by her love of sculpture than of paper cranes.

"I wanted to study fine arts, but my parents said that was a hobby, and not a profession!"

"When I was younger, I always thought paper was just for little kids", says Paik. "It's the most contained, safe medium to work with. It was always the physical change to a material that excited me. When you make something out of clay, you can then fire it, and it becomes hard. You can put a glaze on it, and see the chemical transition". This interest can easily be seen in her ceramic works, where lumpy clay has been shaped into colourful pieces featuring stern metallic blocks, intricate curlicues, and a pair of miniature mountains perched on a glazed hilltop.

A world of functional art

Her office is situated in EPFL's recently inaugurated mechanical engineering building - which, with its metallic, splay-panelled facade, looks a bit robotic itself. Paik says her choice of career was also motivated by a desire to create something that would be indispensable in people's everyday lives. She explains that soft robots belong to a 'second generation' of robots that are small and unobtrusive, yet quick to sense and adapt to user needs.

"We want robots that are close to us in our daily lives, without always having to tell them what to do", Paik says. Her dream would be to create a wearable robot to help with back pain - something she herself suffers from. She's not far from her goal. Wearable robotics is a main focus of the Swiss National Center of Competence in Research (NCCR) Robotics, of which Paik is an active member. "The best solutions recommended for back pain are often weight loss and doing exercises. But I want to create a next-best solution: something you can wear that reminds you to do exercises, and that helps to stabilise your core".

Passing through the 'dirty' lab, where several doctoral students are hard at work assembling new structures (as opposed to the clean lab, where more sensitive materials testing is done), Paik demonstrates a prototype belt with flexible silicone segments that can soften or stiffen in response to bodily movements.

Healthy balance

With multiple research directions, lab management responsibilities, teaching and tenure review preparations, it's a stressful time for Paik. But she is determined to find a healthy balance to the long working hours - something that she says has been helped by the move to Lausanne, a city rather small compared to where she lived previously.

Born in Canada, Paik studied at the University of British Columbia before spending a work-study year with Mitsubishi in Tokyo. She was then recruited by Samsung to work on anthropomorphic robots in South Korea, and the company ended up funding her PhD in mechanical engineering at the Seoul National University. She then worked as a postdoc in Paris and Boston.

"I look for people who are always fixing things"

"I have always lived in cities, eating take-out food and never really cooking for myself. So I am trying to adopt the healthier lifestyle of the Swiss! I am enjoying the nature, and good local produce. I like the outdoor markets here in Lausanne", she says. She's even managing to squeeze French lessons into her busy schedule; she already speaks Japanese and Korean in addition to English.

From her international perspective, Paik says that the relatively small network

of Swiss research institutions makes her work easier, thanks to the harmonisation of research efforts. "The big names and Ivy League schools in the US make it difficult to be coordinated. Here, because universities are not very numerous or very big, it's easy to be in tune with your colleagues. I travel to ETH Zurich regularly, and I am also close to research in other European countries".

Creativity required

Although her robots take up a great deal of her time, Paik also devotes much of her attention to people, hiring and mentoring lab members and teaching classes. For students interested in a career in robotics, she says the most important thing is a sense of creativity. "When I hire my students I look for people who say they are always making or fixing things and who are resourceful", she says.

As a woman in a historically male-dominated field, Paik hopes that soft robotics research - which involves a lot of unknowns, and requires creative and multidisciplinary solutions - will be interesting to female students. "It's important to encourage young female students early on and stress that it's cool to be good at STEM [science, technology, engineering and mathematics] subjects", she says. "There has been strong support for STEM for girls as young as six in the past decade. It's starting to show its impact on the rising number of female students, and I'm very excited about that".

Celia Luterbacher is a journalist for swissinfo.ch.

Engineering a global career

Canadian-born Jamie Paik, 36, is a tenure-track assistant professor in mechanical engineering and director of the Reconfigurable Robotics Laboratory at EPFL. Having lived in Korea and Japan as a child, she studied at the University of British Columbia in Vancouver before completing a PhD at Seoul National University. Paik completed post-docs at the Pierre and Marie Curie University in Paris and at Harvard University in Boston. She is the co-inventor on several patents for robotics technologies, including a motorised tool for laparoscopic surgery.

In the twinkling of an eye

‘Eye tracking’ is being used in an increasing number of fields today. Following the direction of our gaze can help to optimise navigation aids and workplaces, and can be used in psychology. Now eye-tracking instruments are being developed that are less obtrusive to their users. *By Sven Titz*

Pedestrians often try to find their way about using their smartphones. The computer scientist Peter Kiefer and the geomatics expert Martin Raubal are at work together trying to make things easier for them. They work at the GeoGazeLab at ETH Zurich and are trying to refine smartphone maps so that pedestrians will find their way perfectly in any new environment. To this end they are developing special systems that involve attaching an eye-tracking module to one's head. These modules comprise different cameras that are variously focussed on the eyes of the user and on the user's field of vision. By means of eye tracking, Kiefer and Raubal can determine which landmarks pedestrians use to orient themselves. Their findings are interesting. “People ignore some elements on the map completely”, says Raubal. In order not to confuse people, he suggests that these elements – railway tracks, for example – should be left off such maps altogether.

“Eye tracking enables you to observe human behaviour in an uncompromised manner”

Agnes Scholz

This is just one of many examples illustrating the remarkable progress made by so-called ‘eye tracking’ – the process of automatically tracking the direction of your gaze. The importance of this technology shouldn't surprise us, because people's gaze can tell us exactly what's the object of their attention, and also how they feel. Many areas of science and business use this technology today, from cognitive research and sociology to the car industry.

Stressed pilots in front of the camera

Kiefer and Raubal are also busy with another, especially ambitious project, this time in the field of air transportation. They are engaged in a collaboration with the airline Swiss, using eye tracking to monitor the training of pilots in flight simulators. In order not to hinder the pilot, eye-tracking cameras are not installed on his head, but in the cockpit itself. Raubal and Kiefer want to use the trainees' eye movements to recognise what kind of situations place them under stress. Swiss hopes that this method will offer new information to help them further refine their flight training programme.

You can also use eye tracking to help optimise your office space. This is the area of research of Mandana Sarey Khanie, a civil engineer at the Interdisciplinary Laboratory of Performance-Integrated Design (LIPID) at EPFL. People who sit for eight hours a day in front of their computer often complain of sore eyes, tiredness and headaches. This can be because of brightness contrasts in their environment. People usually work more productively if they're in an office with pleasant lighting. Sarey Khanie is investigating how the intelligent use of light can be applied when designing workspaces. Her focus is on offices that are lit up by natural light.

Sarey Khanie's project uses an eye-tracking system that comprises three cameras mounted on a person's head. Two look in the person's eyes while a third records the orientation of their head. Together, they serve to determine the person's viewing direction. Eye tracking enables Sarey Khanie to recognise when a person reacts to light in a systematic way. “In one experiment we observed that people like to look out of the window, and only avoid doing so when the incoming sunlight creates stark brightness

contrasts”, she says. You could carry out a survey instead, to try and find out if people feel they're being blinded by light at the workplace. But such a method would be too imprecise, explains Sarey Khanie. Together with Marilyne Andersen, the Director of LIPID, Sarey Khanie wants to develop software tools to enable architects to carry out simulations that meet three requirements of construction planning: maximising the use of daylight and visual contact with the outside world; avoiding the glare of bright light; and keeping energy use low.

Looking at nothing

Eye tracking is also used in pure research. Psychologists in particular are fond of the technology, because it enables them to observe human behaviour in an uncompromised manner. “Your eye movements aren't something you can really control”, explains Agnes Scholz, a psychologist at the University of Zurich.

Scholz uses eye tracking in order to investigate fundamental thought processes. When people make decisions they can orient themselves on abstract rules, or base their decisions on examples taken from recent memory. Scholz carried out an experiment to see if she could observe differences between these two approaches. Test subjects were asked to assess several people whose profiles were presented to them on a computer screen. In order to check whether recent memory played a role in their assessment, the test subjects were presented with example cases on the monitor before they came to make their own assessment.

When the test subjects were observed by means of eye tracking, it revealed a fundamental difference in their direction of vision. The assessment ran differently if the test subjects remembered the examples they had seen. While they were making



In a flight simulator, infrared flashguns and four cameras help record the gaze of a pilot (left) and his first officer. The combination of flashes and cameras then makes it possible to calculate the direction of vision. Photo: David Rudi

their decision, these test subjects looked at specific areas of the monitor - the empty spaces where the example cases had been shown just before. Psychologists call this behavioural phenomenon 'looking at nothing'. The other test subjects - those who based their assessment on abstract rules - did not engage in this 'looking at nothing'. In future, Scholz wants to find out more precisely when this specific viewing behaviour occurs, and what role it plays in decision-making.

Scholz used a special camera for her eye tracking. It is directed at the eyes of the test subjects and also uses infrared light to measure the geometric characteristics of their pupils. Such systems have been honed more and more in recent years, and now function very precisely. However, they often lack flexibility, especially in cases where people move about a lot without keeping anything firmly in their gaze.

Eye tracking at the conference table

At the Idiap Research Institute in Martigny, Kenneth Funes Mora and Jean-Marc Odobez are developing systems that use relatively inexpensive cameras without high resolution. They register both colours and

distances. Sophisticated algorithms enable a computer to use the pictures from the cameras to determine the direction of one's gaze at all times. The variable angles of the head and eye movements are captured and then converted into data that describes the changes in a person's direction of vision. The researchers can place these camera systems inconspicuously on a conference table in order to study negotiation techniques.

Sophisticated algorithms enable a computer to use the pictures from the camera to determine the direction of one's gaze at all times.

Funes Mora and Odobez patented their new eye-tracking method a while ago now. Funes Mora is currently researching at the Institute only on a 50% post, because in the rest of his time he has to look after their spin-off company, 'Eyeware'.

The two researchers believe that such an eye-tracking system can have many

different areas of possible application. Their newly developed camera is especially suited to investigating people's visual attention, and to supporting the interaction between people and computers. It could be used by a robot, for example, to advise customers in a shopping mall. Applications in the medical field would also be possible - such as in diagnosing disorders like autism, which can be recognised by tracking eye movements.

And this will hardly be the last of their ideas for applying their eye tracking system. "The eyes simply tell you a lot about people", says Funes Mora.

Sven Titz is a freelance science journalist.

Still waiting for smart homes

There's long been talk of 'smart homes', but just talking about them won't make anyone's home smarter. Introducing smart systems is only progressing at a sluggish pace, even though the technological solutions needed are already with us.

By Alexandra Bröhm

We're not starting from scratch", says Georgios Lilis, an electrical engineer at EPFL and a specialist in smart homes. He is busy with a new study on why smart homes are not yet suited for the mass market. "There are all kinds of different systems currently in use to control the various elements in residential homes", he says. That's one of the main problems. Replacing the older systems with smart controls all at once is rarely appealing to property owners, and is generally too complicated for them. So the most important task would be to unite old and new in the most elegant, cost-effective manner possible, says Lilis. He's working on just such solutions at the Electronics Lab of EPFL, where the current focus of investigation is smart infrastructure for water, heating, and energy systems in whole buildings.

The 'middleware' approach

"The market for smart home systems is very fragmented", says Lilis. There are too many solutions on offer, and these systems themselves rapidly become obsolete. In order to give a push factor to the smart-home concept, the EPFL team is working on interfaces. "We call our solution 'middleware' for smart homes", says Lilis. It takes on the function of a kind of interpreter between old and new systems, serving as a link so that existing control systems and the smart systems of the future can find a common language. In this manner, even buildings that don't have the most modern technology could manage the leap into a smart future without anyone having to invest massive sums in them.

What's decisive, says Lilis, is that the individual occupant does not lose on comfort. "People don't like you intervening in their everyday lives". To achieve a better distribution of resources, it would be cheaper if



The smart home is a future that is ever being deferred: the technology exists, but it's expensive and quickly becomes obsolescent. That puts off potential customers. Photo: Keystone/DPA/Soeren Stache

every resident would wash only at a specific time, for example. But people are rarely ready to make such concessions. All the same, if smart homes were to gain wider acceptance, people in Switzerland could most of all save on energy costs. Lilis is convinced of it.

An image problem in German-speaking countries

Felix Wortmann, however, sees other problems. He's a professor of technology management at the University of St. Gallen. "In German-speaking countries", he says, "smart homes also have an image problem because of data security". This unsettles the customer. In practice, these smart systems are also too cumbersome. He understands the problem: it just takes a flick of a switch to turn on a light in a normal home. If you introduce smart solutions, you first have to get your smartphone out, then open the relevant app, and then activate the light.

"The EPFL study proposes a good technological solution", says Roy Smith, who's a professor at the Automatic Control Laboratory of ETH Zurich. Nevertheless, their new approach only solves a small part of the problem. "The main problem lies in the structure of the Swiss housing market", says Smith. Most Swiss people rent their apartments and pay for their own energy supply, either as part of their rent or separately, explains Smith. But the structure is provided by the owner of the property. This

is why they have no financial incentive to take old structures and make them 'smart', saving energy costs in the process.

Property owners have almost no financial incentive to take old structures and make them 'smart'.

Smith sees possibilities for change at best on the legislative level, with tighter provisions regarding energy use and stricter building regulations. A tenant could maybe save just 20% or so of their heating and electricity costs, says Smith. But if the whole country were to save 20% of its energy, that would be very significant indeed. "It's all a matter of incentives" – of this, Lilis is also convinced. When it's about the money in your wallet, then people are suddenly prepared to make concessions after all.

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

A silver bullet for bacteria

An old household remedy claims that milk stays fresh for longer if you put a silver coin in the jug. In fact, silver does possess antimicrobial characteristics. It's even effective against bacteria that are resistant to antibiotics. Now it could also be employed in nanomedicine.

Two percent of all artificial hip joints have to be replaced because a bacterial layer grows on them. Researchers at the University of Fribourg are now using silver to develop a coating for such prosthetic implants. They pack the silver into tiny beads of silica just a few nanometres across. Over the course of several months, the silver oozes out through the porous silica casing. These beads are reminiscent of a baby's rattle, which is why they are called 'nanorattles'. However, this innovative material still has to undergo several tests before it can be used in clinical practice. "We only want to kill off bacteria. We don't want the body to overreact to it", explains the project head, Katharina Fromm.

The silver that is released is concentrated enough to be able to kill off various types of bacteria. In collaboration with Carole Bourquin, the researchers in Fribourg succeeded in proving that nanorattles are also non-toxic to dendritic cells in the immune system. These rattles were taken up into the cell interior, but had no negative effect. There was no unwanted immune response against the nanorattles. "We can't exclude the possibility that there will be a strong reaction from one type of cell or another, but it's looking good", says Fromm.

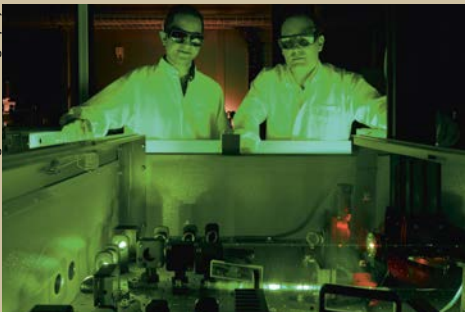
Now her team is experimenting with double-walled nanorattles that are supposed to release the silver over the course of three years – enough time to provide an implant with long-lasting protection against infection. *Yvonne Vahlensieck*

M. Priebe et al.: Antimicrobial silver-filled silica nanorattles with low immunotoxicity in dendritic cells. *Nanomedicine* (2016)



Silver-bearing nanobeads could keep hip joints free of bacteria.

Scanderbeg Sauer Photography



These PSI researchers are using lasers to create long-wave flashes of light.

Customised terahertz light

Researchers at the Paul Scherrer Institute (PSI) have developed a compact terahertz source that creates strong, precisely adjustable pulses such as could only be produced by a large accelerator until now. Terahertz light comprises electromagnetic waves located between the infrared and microwave frequency range, i.e., from 0.1 mm to 1 mm. But it cannot be created at sufficiently high intensity by either lamps or antennae. The researchers at PSI illuminate an organic crystal with laser light in order to stimulate it into emitting strong terahertz light.

"With our system, it's possible to create either pulses with a broadband spectrum or – and this is new – one pulse with an extremely narrow bandwidth", explains Christoph Hauri, one of the researchers at PSI. "And we can do this in a field that is more than a thousand times stronger than was previously possible in the laboratory".

The best-known use of terahertz light today is in the body scanners employed for security checks at airports. The rays penetrate textiles, making visible any objects hidden underneath. But they are also suitable for a host of other applications. A customised terahertz pulse can alter the optical or electrical properties of a material for a very brief moment before it reverts again to its original state. "This opens up innovative possibilities in material research, in data storage, and in helping to make electronic components even quicker in future", explains Hauri, who carried out his experiments in a laboratory in Moscow in collaboration with a Russian colleague. *Barbara Vonarburg*

C. Vicario et al.: Multi-octave spectrally tunable strong-field Terahertz laser. *Arxiv preprint* (2016)

Morphing wings take off

The rigid wings of today's aircraft have discontinuous surfaces that generate undesirable turbulence. Now researchers at ETH Zurich have developed morphing wings. The aim of their work is to reduce air resistance and increase manoeuvrability.

Giulio Molinari and his team have succeeded in this endeavour using piezoelectric actuators, ceramic components that expand and contract under high voltages (1,500 V). The morphing elements replace the ailerons and feature a continuous profile with no sharp angles. "The challenge was in designing a structure capable of resisting aerodynamic forces but without sacrificing the shape-changing characteristics", says Molinari. Perfecting the new wing design involved the use of computer simulations to find the best possible profile whilst also considering aero-elasticity, in other words, the vibrations caused by the flow of air around the wing.

It's already been tested on a scale-model plane. "The optimisation tool we developed can be applied to any aircraft", says Molinari. "The advantage is higher manoeuvrability and reliability, and the lack of any particular maintenance needs". *Nathalie Jollien*

G. Molinari et al.: Aerostructural Performance of Distributed Compliance Morphing Wings: Wind Tunnel and Flight Testing. *AIAA Journal* (2016)



Morphing the end of the wing increases lift considerably and keeps air resistance low.

Giulio Molinari

Science's spam epidemic

Predatory publishers and their unsolicited e-mails plague more and more researchers. What can be done to halt the outbreak?

By Edwin Cartlidge

“Hope this email finds you in superior spirits”. So began a message that recently arrived in the inbox of Adriano Aguzzi, a neuropathologist at the University of Zurich. Although an apparently innocuous, even friendly, opening line, Aguzzi knew what would follow. There would be an invitation by some obscure company located who knows where on the planet to submit a paper to a journal he had never heard of, or to participate in a conference that might well never take place. As such, he had no hesitation about what to do. He hit ‘delete’.

That email – sent by the firm MedCrave to ask for submissions to *Journal of Dairy, Veterinary & Animal Research* – is part of a rising tide of academic spam arriving at researchers’ computers the world over. Aguzzi, who receives about half a dozen such messages from various publishers every day, says it is impossible to stop the e-mails at source – “you can write back inflammatory e-mails but they are just disregarded”, he says – and adds that spam filters are not much use. “In the good old days, people offered you Viagra pills or some shady business deal in Nigeria”, he says. “But scientific spam is different, it is very hard to weed out”.

The e-mails are not merely a nuisance, however. They are sent by organisations that are ostensibly set up to exploit the potential offered by the Internet for rapid and free dissemination of scientific results, but which in practice appear to be just after a quick buck. Anyone heeding a call for submissions usually finds that their manuscript is accepted after just a few weeks, or even days, having undergone little or no peer review and coming with a bill of several hundred dollars or more. Should the unwitting academic then ask for their paper to be withdrawn – to avoid any dent to their reputation – they could be presented with a withdrawal fee.

These practices have earned such publishers the label ‘predatory’. But the organisations in question often do more than just publish (fake) journals. Three

years ago James White, a plant scientist at Rutgers University in the US, accepted an invitation to be a board member of a journal published by OMICS International in India (see box on p. 44). White said he saw nothing fishy about the journal, but he subsequently found out that OMICS had, without him knowing, listed him as a speaker at a conference on insects that the company was organising. White says he was outraged that his name could have been used to lure other (paying) scientists to the meeting. “My understanding is that people are being duped”, he concludes.

Keeper of the blacklist

According to Jeffrey Beall, an academic librarian at the University of Colorado in the US, predatory publishers also pose a broader danger. Beall says that they undermine the trust fundamental to maintaining rigour within science, and that they are starting to flood scientific literature with erroneous results. In fact, he and a couple of colleagues have argued that predatory journals pose an ‘existential threat’ to science.

“We have to be much more discriminating about where we publish”

James White

Beall is famous for a blog, *Scholarly Open Access*, where he maintains an up-to-date list of “potential, possible, or probable” predatory publishers. Indeed, it was he who coined the term ‘predatory publisher’. To decide who should go on the list he makes a subjective judgement based on some 30 criteria he has drawn up concerning bad editorial and business practices. He also maintains a list of individual predatory journals without a specific publisher, and provides general information (but no list) regarding questionable upcoming conferences.

Having started up in 2010, the list now contains the names of over 1,000 dubious

publishers. One of the most infamous of these is the aforementioned OMICS. Among the other notable inclusions is an outfit known as *Cardiology Academic Press*, which in 2013 bought the journal *Experimental & Clinical Cardiology* from a respected publisher in Canada and then started charging authors for publication. The number of published papers then skyrocketed – from 63 to over 1,000 in the space of a year (the company appears to be no longer active).

Hijacking journals

Other predatory publishers go one step further and ‘hijack’ journals. They do this by setting up fake websites bearing the names of established journals, and then simply collect the article processing charges provided by hoodwinked authors. For instance, Mexico-based *Revistas Académicas* says it publishes the *Cahiers des sciences naturelles* of the Nature Museum in Sion, Valais, with a hard-to-identify Dr. D. Nowack, Switzerland, as editor-in-chief. Other hijacked publications include a 200-year-old forestry journal from Poland, an Icelandic life sciences journal and a South African botanical journal.

Keeping tabs on predatory journals is a time-consuming and often thankless undertaking. While praised by many scientists for his vigilance, Beall has also been accused of tarring different types of publisher with the same brush – from the potentially criminal to the merely amateurish. Indeed, the principle of charging authors to have their work published has been adopted by many legitimate, respected open-access journals. The idea here is to make scientific papers free to access online, rather than having them locked behind the paywalls of traditional subscription publishers. In fact, open-access publishing has been gaining significant ground in recent years, with many governments now requiring publicly-funded research to be made freely available.

But Beall believes that charging authors creates an inherent conflict of inter-

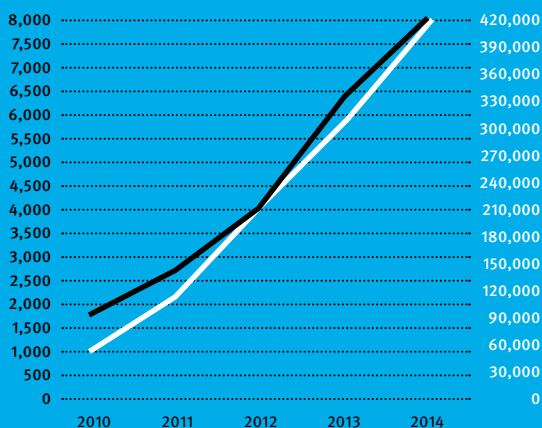
Predators in the pack

The number of articles published in predatory journals has exploded from 50,000 to 400,000 in four years.

The steady increase of predatory publishing

Around 1,000 publishers manage some 8,000 predatory journals, in addition to some 4,000 inactive journals that have not published any article.

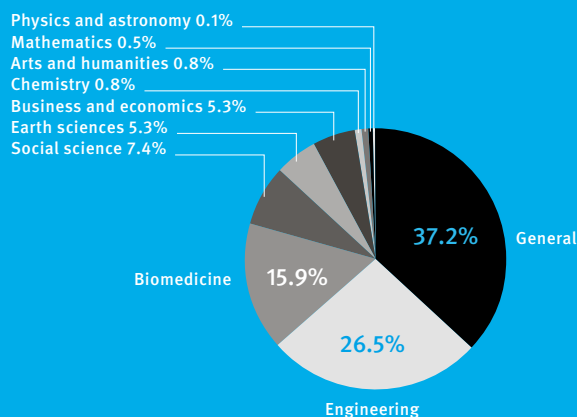
- Number of predatory journals
- Articles in predatory journals



Varying prevalence in research disciplines

Compared to non-predatory publishing, engineering and economics appear overrepresented, with biomedicine and physics underrepresented.

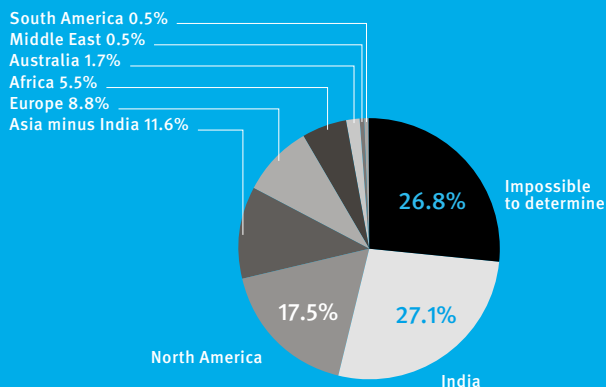
Articles published in predatory journals per discipline



Publishers based in Asia

Asia is home to 38% of all predatory publishers. 42% of all single-journal publishers are based in India.

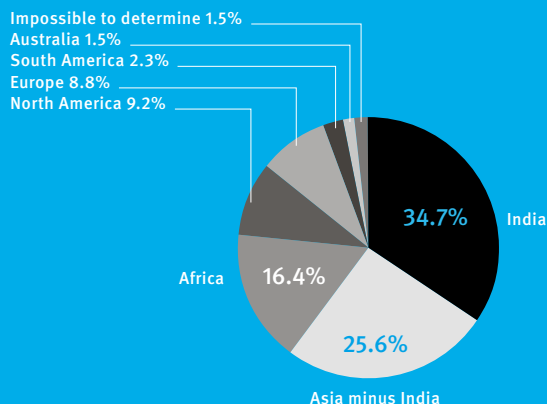
Predatory publishers per region



Authors often from Asia and Africa

77% of authors come from Asia or Africa. The ratio of predatory/non-predatory articles is 6% for US-based authors, 277% for India and 1,580% for Nigeria.

Corresponding authors per region



Source: C. Shen and B.-C. Björk, BMC Medicine (2015) 13:230

est, with publishers motivated to accept as many papers as possible – in order to increase profits – and therefore to lower their standards. He contrasts this with traditional scholarly publication, in which, he argues, the possibility of libraries withdrawing their subscriptions means that publishers are forced to maintain high

standards. “Now”, he says, “you can publish anything you want as long as you can afford to pay a publisher”.

The white list

Faced with the bad press of predatory journals, open-access publishers have raised standards. The Directory of Open Access

Journals (DOAJ), sponsored in part by open-access publishers, maintains a currently 9,000-strong list of what it considers to be bona fide journals. In the years following its creation in Sweden in 2003, the DOAJ did not use strict criteria for drawing up its list, but since 2014 it has required applicants to provide detailed information on

licensing, transparency, peer review and other areas. It now accepts less than 40% of new applications, and also regularly removes substandard journals from the list.

The DOAJ managing director Lars Bjørnshauge contrasts their approach with that of Beall, whom he describes as “just stigmatising” publishers. “We spend quite a lot of time with publishers”, he says. “We are trying to help them do a better job”.

Others also take issue with Beall. Bo-Christer Björk, an information scientist at the Hanken School of Economics in Helsinki, says that he is “not overly” worried about the potential conflict of interest that arises with author-paid publishing. He argues that the possibility of having their impact factors listed by Thomson Reuters, alongside those of long-established journals, strongly motivates open-access publishers to keep standards high. “It is all about reputation”, he says.

400,000 articles a year

Last year, Björk published a study along with the doctoral student Cenyu Shen on the rise in predatory publishing (see charts on p. 43). They worked out that the total number of papers published worldwide in predatory journals rose from about 50,000 in 2010 to more than 400,000 in 2014, which compares with the 1-to-1.5 million papers published yearly by journals indexed by Thomson-Reuters. However, the pair found that there were big variations from one field to another. They also identified huge geographical differences, both in terms of where publishers are based and where authors live. In both categories the developing world dominates, with India by far the largest offender.

Several dubious publishers imitate well-known specialist journals and even put fake webpages on the Internet.

As such, argues Björk, predatory publishing is not a huge problem in the West. He believes the reason that dubious journals and their authors proliferate in the developing world is because there is “a market for academics who are desperate to publish their papers”, a phenomenon that he says is amplified by governments in India and elsewhere insisting that scientists publish in international journals, while not monitoring the quality of such publications.

Not everyone is so relaxed about predatory journals. Aguzzi agrees with Beall that unscrupulous publishers undermine trust within “the edifice of science” and that the author-payment scheme – known as gold open access – lies at the root of the problem. “The open-access model is not tenable as it stands”, he says.

Aguzzi points out that there continues to be some overlap between journals in the DOAJ and publishers on Beall’s list, including even quite well-established Western publishers such as Frontiers. Set up in 2007 by Henry and Kamila Markram, both neuroscientists at EPFL, Frontiers today publishes several of the world’s most-cited, open-access journals, according to its website. However, it has been sharply criticised by many researchers, including 31 editors of three of its medical journals, who last year wrote a manifesto expressing grievances about the company’s peer-review processes and alleged editorial interference. Frontiers responded by rebutting the objections and sacking the editors.

Platinum instead of gold

Aguzzi advocates what is known as platinum, rather than gold open access. Used at the Swiss Medical Weekly, of which he is editor-in-chief, this involves ditching author payments and instead financing the costs of publication via funding from research agencies, university libraries, scientific academies or philanthropic organisations. He acknowledges that this approach requires “a lot of fundraising to make it work”, but he nevertheless thinks it will become the main source of funding for scientific publishing in the long term, and in the process pull the rug from under predatory publishers.

Björk, however, is not convinced. He notes that a consortium designed to fund open-access publishing in particle physics, known as Scoap3, took several years of negotiation to set up and even then the biggest journal in the field backed out at the last minute. “The idea is nice in principle but so very difficult to set up in practice”, he says.

For White, there is no easy solution. “The scientific publishing world has changed and we have to live in this reality”, he says. “I think we just have to be careful. We have to be much more conservative and discriminating about where we publish”.

Based in Rome, Edwin Cartlidge writes for Science and Nature.

The top predator

According to figures provided by its director, Srinubabu Gedela, the open-access publisher OMICS International has enjoyed a meteoric rise. After being set up in Hyderabad, India, in 2007, the company was publishing 50 journals by 2009, then 200 by 2012, and now produces over 700 titles – thanks to a 50,000-strong army of editorial board members and reviewers. It also organises more than more than 3,000 scientific conferences around the world each year, he says.

However, that spectacular growth has attracted criticism and condemnation – from individual scientists, including Jeffrey Beall, and also from the US Federal Trade Commission, which is suing the company for deceiving academics and hiding publication fees. The Commission accuses OMICS of shoddy peer reviewing, and making false claims about the identity of editorial board members.

Gedela maintains that the allegations are false. He says that he is “100% sure” that all 30,000 articles published by OMICS last year were peer-reviewed, estimating that some 40% of submitted papers were rejected. He contrasts the roughly USD 250,000 of profit that he says the company made last year with the “millions or billions of dollars” that subscription publishers would have made from a similar output.

Combating health paranoia on the Internet

Many people aren't properly able to assess online information about their health. New research shows what assessment criteria they use, and how they can be helped.
By Florian Fisch

The general practitioner is no longer the first port of call when people take ill. "More and more people are making decisions on their health alone, outside any kind of medical consultation", says Nicola Diviani of the University of Lucerne, who is studying how people get online information on their health. Instead, patients look for diagnoses and second opinions on the Internet.

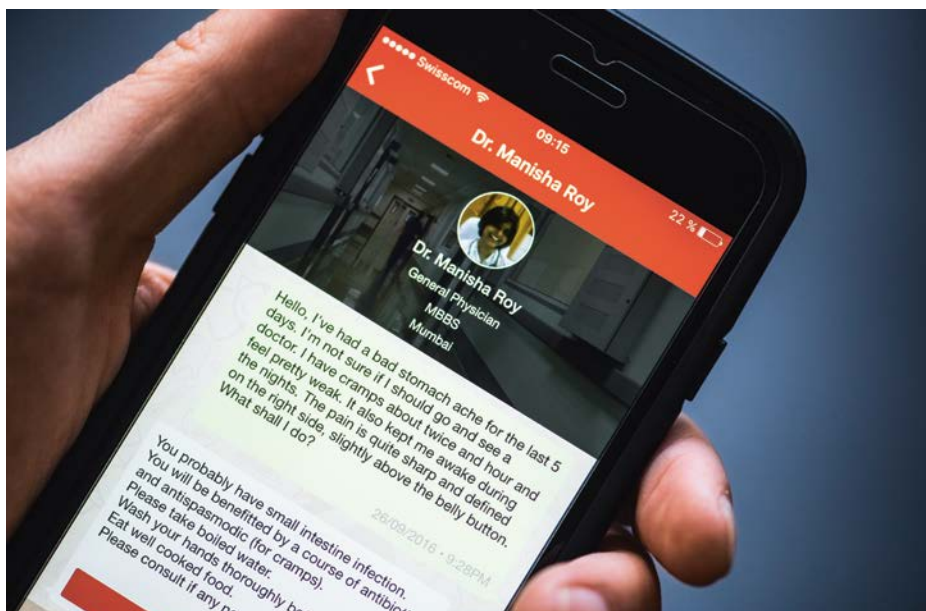
This can increase one's autonomy and save health costs, but it also has its drawbacks. In 2015, the Federal Office of Public Health (FOPH) assessed the health competence of 54% of the Swiss population to be between 'problematic' and 'insufficient'. Switzerland is in the lower mid-table when compared to the rest of Europe. The Netherlands are top with 29%, while Bulgaria is at the bottom with 62%. However, the FOPH maintains that Switzerland's poor ranking is primarily because of people's feelings towards inoculations, which can range from uneasy to critical.

"It's not possible to control the flow of online information"

Nicola Diviani

It is this low level of health competence that is the main problem when looking for information online. Diviani has been able to confirm this in a systematic literature study. "The problem isn't finding the information, but evaluating it". People with a low degree of health competence assess websites of modest quality to be better than high-quality websites. Things become disturbing when people stop trusting public authorities, use search result rankings as quality indicators, or judge a website on the strength of its images instead of its content.

In a mixture of interview and questionnaire, Diviani furthermore found that the majority of her 44 respondents did not even question the quality of websites.



Here Lybrate.com recommends antibiotics and boiled water against stomach pain. Photo: Valérie Chételat

Diviani finds this problematical, because "it's not possible to control the flow of online information".

Despite this, a kind of 'control' is the declared aim of the foundation Health on the Net (HON) in Geneva. HON gives certificates to websites that meet its criteria. The website krebbsliga.ch of the Swiss Cancer League, for example, has been certified now for 18 years. Other websites, such as sprechzimmer.ch, are not certified. HON provides search functions to help people to find their way through the information jungle.

Discussion groups are better

But not all experts are concerned to the same degree about the health of the population. "It is a common mistake to treat 'the Internet' as a homogeneous whole", says Jennifer Cole of the University of London. "The individual's ability to evaluate critically the website or the organisation that has posted it is more important than their ability to evaluate the information itself. There isn't a single study that showed that people with low literacy act stupidly on health information they find on the Internet, and come to harm because of it".

Cole and her team evaluated the quality of information offered in three different discussion groups: on HIV, diabetes and chickenpox. They reached the same conclusion in each case: "Most of the information assessed in this study was considered

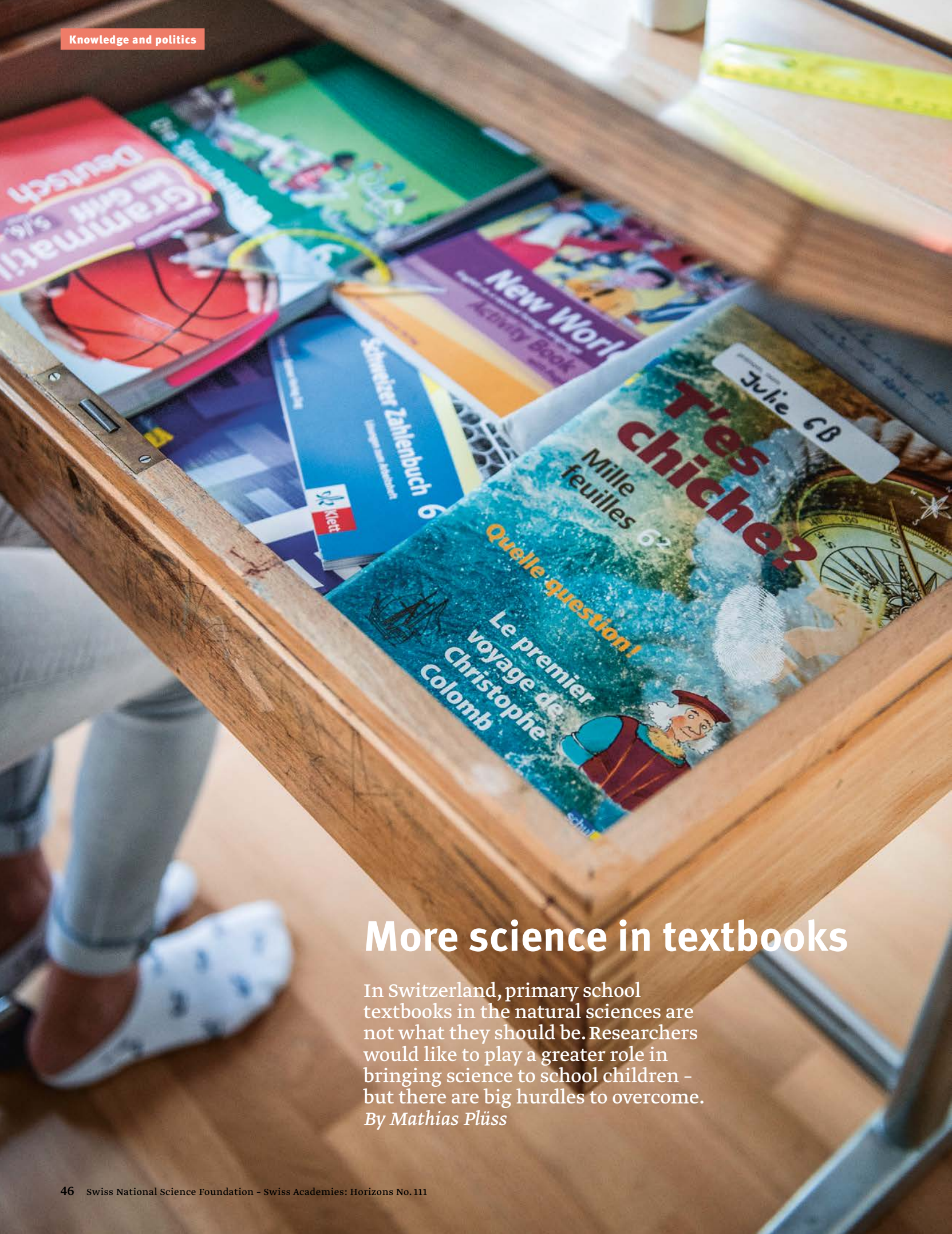
to be of reasonably good quality". Cole further adds that "online forums are better because users can see how others reacted to the information. Did they agree, disagree, urge caution etc.?" One prominent example is the mailing list of the Association of Cancer Online Resources (acor.org). There, cancer sufferers and their relatives have been giving each other advice for over 20 years. According to its founder, Gilles Frydman, people sometimes also demand proof for claims that people make on the site.

Diviani and Cole agree that education and the quality of information on offer are important. But Cole would like to see more discussion instead of the presentation of one-sided, static information, even in the case of controversial topics such as inoculations. "If people can talk to others about their concerns, the majority view is likely to be the sensible one".

Florian Fisch is a science editor at the SNSF.

N. Diviani et al.: Exploring the role of health literacy in the evaluation of online health information: Insights from a mixed-methods study. *Patient Education and Counseling* (2016)

J. Cole et al.: Health Advice from Internet Discussion Forums: How Bad Is Dangerous? *Journal of Medical Internet Research* (2016)



More science in textbooks

In Switzerland, primary school textbooks in the natural sciences are not what they should be. Researchers would like to play a greater role in bringing science to school children - but there are big hurdles to overcome.

By Mathias Plüss

It's paradoxical. For years people have kept repeating the mantra that education is Switzerland's 'only natural resource'. So year after year, billions of francs are invested in Swiss schools and universities. But in the end, what's lacking is one of the most crucial components of the educational process: good school textbooks.

The situation differs from one subject to another. But many experts are unanimous in believing that it's natural science textbooks for primary schools that are the main problem. Some of the current textbooks are "completely old-fashioned, both didactically and in their content", says the biologist Markus Wilhelm, a lecturer in the didactics of the natural sciences at the University of Teacher Education Lucerne (PH Luzern). Lucien Criblez, professor of pedagogy at the University of Zurich and a member of the Zurich Education Council, also says that there is "a great need for action". He confirms that the publishing houses themselves are aware of the situation. But it might take a while before things actually change.

Communicating complexity

There is a textbook in the natural sciences, currently in use in the canton of Bern, that is emblematic of the current problems. It already had to be revised a few years ago because it contained serious mistakes. But the underlying curriculum is still valid until 2018, despite describing evolution as a mere 'hypothesis' and placing it on the same level as religious belief. This problematical state of affairs is a result of the amateurish approach taken to the topic in the 20th century. "In subjects such as German and maths, proven experts have repeatedly been involved in developing school textbooks", says Criblez. But this didn't happen in the natural sciences, partly because the material itself is difficult: "The more complex the material, the greater are the didactic challenges in communicating it to school pupils". And as everyone knows, the best experts aren't always the most gifted educators.

Another obstacle in Switzerland is the fact that things are done on a small scale. "Every canton has its own curriculum", says Markus Wilhelm. "That's why many cantons have developed teaching resources to suit their own needs". But limited public funding has meant that the people appointed to the task were those willing to work almost for free. These were usually committed local teachers who loved their profession - but who sometimes simply lacked the necessary expert knowledge.

Everything is going to change soon, however. For one thing, lecturers at the newly created Swiss pedagogical universities constitute a body of potential textbook authors with a sound training both in didactics and in their specific fields of expertise. And the

implementation of 'Curriculum 21' means that new textbooks are being designed that no longer have to take cantonal particularities into consideration. So the time is ripe for a qualitative leap.

What is the real impact of textbooks?

The Swiss Academy of Sciences (SCNAT) is also aware of the problems being faced. "We're not asking for the textbooks to be written by scientists - the education experts at the pedagogical universities can do a better job", says Helmut Weissert, professor emeritus in geology at ETH Zurich and President of SCNAT's Committee for the Promotion of Young Talents. "But we'd like to have some input when it comes to questions such as: What knowledge actually belongs in a school textbook? Where did new scientific focus areas emerge in the last ten or twenty years?" Weissert believes that the people drawing up the textbooks still haven't yet opened up the doors to dialogue wide enough. Nevertheless, initial contact took place in late August 2016, when publishers, educators and scientists came together for a joint workshop in Bern.

Weissert offers a concrete, negative example from his own field. "In the curricula and textbooks, inanimate and animate nature are still kept strictly apart. But we've known for some time that biological and geological processes are closely linked to each other". In order for such crucial knowledge to enter into textbooks, it would be an important step for authors to meet with experts for a roundtable discussion before actually starting work.

As everyone knows, the best experts aren't always the most gifted educators.

Markus Wilhelm from PH Luzern supports this suggestion. He's had very positive experiences himself. When he was writing a textbook on evolution, he made sure to take in-depth advice from the evolutionary biologist Heinz Richner from the University of Bern. "At first I thought I wouldn't need him, because I'm an expert myself", says Wilhelm. "But he gave me incredibly good advice. And in at least one particular case he prevented me from getting into hot water". But what he lacked after writing his textbook was any kind of evaluation as to whether it really had the impact that was intended. German-language school textbooks are almost never subjected to any such basic assessments.

The difficult art of collaboration

Bruno Bachmann works at Schulverlag Plus in Bern. And when he hears the demands being made by academics, he sighs a little. "I understand that natural sci-

tists would like to be more closely involved with the development of textbooks", he says. "Factual correctness and being up-to-date are naturally also important to us". Basically, he's in agreement with the concrete suggestions being made: having discussions with experts at the start, and evaluating the textbook once it's finished.

But there are all kinds of problems in practice. "It's our experience that collaborating with university professors is difficult", he says. "Usually, they're so busy that they don't have the breathing room they need for it". And besides, there are always time constraints when developing school textbooks, while the budgets are so tight that it's often illusory to think that additional expense could ever be incurred.

"But we'd like to have some input when it comes to what knowledge belongs in a school textbook"

Helmut Weissert

Under Bachmann, Schulverlag Plus is currently collaborating with the publisher Lehrmittelverlag Zürich to create a new series of primary school textbooks called 'NaTech 1-6'. These books are skills-oriented and are due to be published in 2017, in good time for the introduction of Curriculum 21. "The new curriculum was agreed and confirmed in 2015", says Bachmann. "You really ought to have five to six years to develop a new textbook. But if we only publish everything in 2021, then people will once again say: We've got a new curriculum, but we haven't got the books to teach it". So 'NaTech' has been conceived in the traditional manner. There were no roundtable discussions with experts at the outset, and there'll be no proper assessment at the close. There simply isn't enough time for this, says Bachmann.

All the same, the authors - mostly education experts from the pedagogical universities - are collaborating here and there with subject experts from the universities whenever they have concrete, subject-specific questions. And this approach is intended to be expanded further. The Academies would like to create a pool of experts to whom publishers and authors can refer when they have questions, when they need counter-checks, or when they need scientific partners for more in-depth collaborations. The preliminary work for such a pool is currently being carried out.

Mathias Plüss is a freelance science journalist who writes regularly for Das Magazin.

INTERVIEW

“I see myself as a cartographer”

Benedikt Ziegler



After an artist's residency on a ship in the Arctic Ocean in 2014, the Zurich-based artist Sandra Kühne has now arrived in Saudi Arabia on the artists-in-labs residency programme. She will spend three months in a marine biology lab at Kaust, Saudi Arabia's main technical university, near Jeddah.

What interests you about marine science?

It is a multidisciplinary field of research combining diverse areas such as biology,

ecology and oceanography. I'm interested in exchanging knowledge with the research scientists. I want to discuss similarities and differences in the ways we visualise data and map space, as well as ephemeral phenomena such as ocean currents.

Why Saudi Arabia?

Because of the Red Sea Research Center at Kaust and their research on coral reefs, which constitute one of the most diverse ecosystems in the world. They are very fragile and consist of a community of interdependent species. I'm interested in observing and understanding this complexity and vulnerability. Focusing on coral reefs, I will look for ways to show themes of interaction, balance and symbiosis through my art.

What is the link between marine science and your art?

I believe that art and science are related in terms of developing ideas, observation methods, work processes, visualisation and model-making. I imply methods of cartography in my artistic research and practice. I see myself as a cartographer, collector, writer, translator and discoverer. I explore strategies in mapping both real spaces and spaces of language. In my cut-outs and installations, which are mainly made from paper, I translate two-dimensionality into three-dimensionality. I'm creating and presenting drawings and maps as objects in space, where lines lose their balance: they shift and change their shape just like the world's fragile ecosystems are changing.

FIVE QUESTIONS

“Research is a fundamentally international activity”

Annette Bourellier



Thomas Zurbuchen has been appointed as the new head of science at NASA. A Masters and PhD graduate in physics from the University of Bern, he is the first non-US-born citizen to assume this position.

What will the coming years bring?

NASA will continue to address big cosmic questions about the mechanisms that underlie Nature, and especially the origin of life and new habitats. By the end of the next decade we will be able to image extrasolar planets, for example. We will continue to study phenomena such as volcanic eruptions, tsunamis and changes

in our atmosphere and oceans, in order to make better weather predictions and save more lives.

What is the status of fundamental research at NASA?

We do both fundamental and applied research. While the former tries to answer some of the above questions about our origins, the latter continues to develop technologies and tools to avoid environmental disasters, such as asteroids that could hit Earth.

How do you feel about commercial competition like SpaceX?

Commercial activities are very welcome to NASA, since they are a sign of economic growth. Private approaches also create new knowledge, and we see them as constructive partners with whom we can collaborate to create better spacecraft, for example.

NEWS

Boosting the outreach of scientific findings

Wikipedia exposes more people to research findings than any other source, shows a University of Chicago study that analysed 19.4 million articles and their citations. Open access journals are 47% more likely to be cited in Wikipedia. doi.org/brz4

Reviewing the reviews

The new website Academic Journal Reviews allows scientists to share their experiences with peer-reviewed journals, reporting on issues such as the fairness and speed of peer-reviewing processes. academicjournalreviews.com

Narcissism and misbehaviour are correlated

Narcissism is more prevalent among scientists in high academic positions and correlates with misconduct, claims a survey that examined 535 biomedical scientists in the Netherlands. doi.org/brz5

An open database on clinical trials

Ben Goldacre, an advocate of medical data transparency, launched a beta version of OpenTrials.net in October 2016. This online database gathers information about clinical trials, allowing anybody to add relevant data.

Artificial intelligence for researchers

The platform Iris.ai uses machine learning to classify abstracts of scientific articles in order to suggest relevant literature.

Facebook money for science

Mark Zuckerberg and his wife Priscilla Chan announced their plan to invest three billion dollars in disease prevention and therapy. A USD 600 million research hub is being planned in San Francisco.

What's your relation to Switzerland?

Even though I have been a US citizen for ten years now, my roots lie in Switzerland. I don't think I would be here today if the SNSF had not supported my initial plans to go abroad. After all, research is a fundamentally international activity and Switzerland is a great place to ignite it.

How is Swiss space science perceived abroad?

Switzerland has always been at the forefront of space science, from the first experiments on the Moon carried out with Swiss instruments to the discovery of the first exoplanets and the development of precision instruments in today's spacecraft. Switzerland could maybe try a bit harder when telling people about its immense contributions to space science.

The block chain conquers logistics

The decentralised digital currency Bitcoin has inspired many applications. A Swiss start-up hopes the underlying block-chain technology will ensure legal compliance in the distribution of medicines.

Journalist: Daniel Saraga

Infographics: Ikonaut

1 Temperature control

As of 1 January 2016, the European directive 'Good Distribution Practice' will govern the temperature of medicine during delivery. A Zurich start-up, Modum, has since emerged, offering new technology tested in partnership with the pharmaceutical industry.

2 On-board sensors

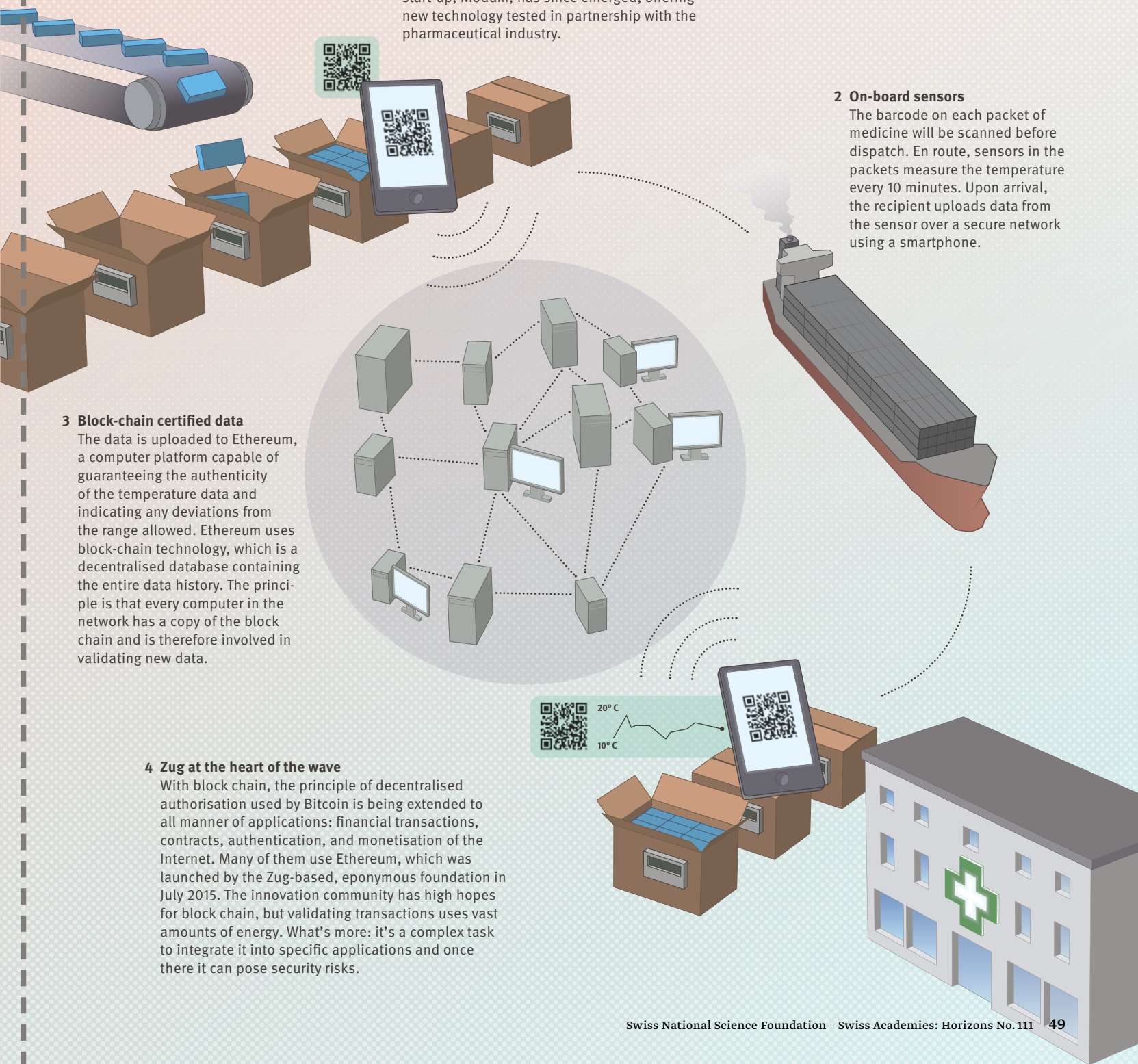
The barcode on each packet of medicine will be scanned before dispatch. En route, sensors in the packets measure the temperature every 10 minutes. Upon arrival, the recipient uploads data from the sensor over a secure network using a smartphone.

3 Block-chain certified data

The data is uploaded to Ethereum, a computer platform capable of guaranteeing the authenticity of the temperature data and indicating any deviations from the range allowed. Ethereum uses block-chain technology, which is a decentralised database containing the entire data history. The principle is that every computer in the network has a copy of the block chain and is therefore involved in validating new data.

4 Zug at the heart of the wave

With block chain, the principle of decentralised authorisation used by Bitcoin is being extended to all manner of applications: financial transactions, contracts, authentication, and monetisation of the Internet. Many of them use Ethereum, which was launched by the Zug-based, eponymous foundation in July 2015. The innovation community has high hopes for block chain, but validating transactions uses vast amounts of energy. What's more: it's a complex task to integrate it into specific applications and once there it can pose security risks.



Science: A tale of 1,001 stories

By Martin Vetterli

When Shahryar, the Persian king from the legendary Arabian Nights, discovers that his wife has betrayed him, he kills her and decides to marry a virgin every day and decapitate her the next morning. But after having killed 1,000 women, he



Nik Hunger

meets the legendary Scheherazade, the vizier's daughter. During their first night together she tells him a story, which she interrupts right before the climax. Since the king wants to hear the end of it, he spares her life for that night, telling her to come back the next day and finish the story. But Scheherazade begins another tale on the second night, which she again stops halfway through, and again the king spares her life. And while the king waits endlessly for new resolutions to new stories, Scheherazade ultimately finds a way to survive ...

other tale on the second night, which she again stops halfway through, and again the king spares her life. And while the king waits endlessly for new resolutions to new stories, Scheherazade ultimately finds a way to survive ...

The Arabian Nights remind me of another grand human tale: science. Research also narrates a never-ending story – that of knowledge – in the form of ever new hypotheses. And since we're able to test them empirically, these individual 'stories' of science endlessly confirm, extend or negate the ones that came before.

Many of these findings are just as fascinating as the stories of the Arabian Nights. In the four years when I was president of the SNSF, some 400 new animal species were discovered, mostly in the Amazon. And some of them are truly incredible, like the 'walking' fishes or the never-before photographed Asian bicorn! Research on our human body recently described a new form of ligament found in the knee, as well as a new type of lymph vessel that goes directly into our brain. Our own past has also been shaken up by science. The oldest cultural paintings seem to come from Indonesia, not from Europe as was previously assumed. Not to mention the extinct Neanderthals, who were so promiscuous that they apparently even had sex with us modern-day humans. The realm of the macrocosm has

also offered many new tales recently, the most fascinating being probably those about exoplanets. From the general disbelief of a few decades ago, via the first discovery in the 1990s by Swiss astronomers in Geneva, to the very recent detection of an Earth-like planet not too far away, these planets have reinvigorated ancient human dreams of putative extra-terrestrial life forms.

Taken together, the big story that science is telling us every day, and that we thought we knew so well, is also being retold continuously. And each resolution is just the beginning of another story. Will it ever end? I don't think so, since scientific stories are probably also always told only halfway through, like the stories of Scheherazade, who studied philosophy, the sciences and the arts. And while we, like the king, endlessly wait for the next resolution to come, we may, like the princess, ultimately find a way to survive as a human species, too.

To be continued ...

Martin Vetterli is president of the National Research Council until the end of December 2016 and a computer scientist at EPFL.

Letters to the editor

Profit-oriented science is obstructive

It is certainly worth encouraging open science (Horizons 110, September 2016): too much happens within closed circles, and too little is communicated openly. Both scientists and the private sector are very interested in bringing about change. The latter, however, is not always exemplary in the way it goes about it. To a large degree, it's private or profit-oriented interests preventing greater openness. But the private sector, too, has to learn that open science and open technologies are advantageous. This is why well-known companies are now relying on open source IT systems. Regrettably, such far-sighted behaviour tends to be the exception rather than the rule. In general, it seems advisable to me to develop innovative methods of communication that take optimum account of both general and particular interests.

Prof. Daniel Speiser, University of Lausanne

Not very open

What I missed in the article 'The long march to open science' (Horizons 110, p. 20) was a clear link to possible solutions. It mentions as an example the efforts of the Global Alliance for Genetic Health, which "has made a carefully differentiated permit model for the release of data by patients, and has developed algorithms to aid

data access". It would have been nice to find here an Internet link to see how and by whom these algorithms can be used. Without the link, it is not very 'open'.

Marcel Zwahlen, Institute of Social and Preventive Medicine, University of Bern

The ill-equipped trekker

The debate between Astrid Epiney and Patrick Schellenbauer (Horizons 110, p. 6) reflects a 40-year-old episode involving ETH Zurich and University of Zurich students. The conclusion was that humanity probably needs both its specialists and its generalists. Without the latter, it would wander randomly much like a trekker without a map, and without the former, it would, like the unequipped trekker, fall victim to the elements.

Edgar Müller, Lausanne

Taking it out on the chalet

According to a recent hypothesis ('The Swiss chalet – not quite so Swiss', Horizons 110, p. 35), the chalet wasn't a Swiss invention at all. Myth-busting is well-regarded these days and ridicule is the preferred method. Nevertheless, when it involves a people shaping their own traditions using myths created by foreigners, might it not be a sign of opening up to others, in line with the current wave of political correctness? If so, it should be a cause for joy among researchers, instead of leading us to believe that there's been a

weakening of the relationship between the Swiss people and their myths.

Philippe Jaton, Lausanne

Centuries-old school of thought

The ideology that Mr Schellenbauer applies to argue against generalist universities (Horizons 110, p. 7) becomes obvious when we observe how he affirms the principle of 'usefulness' to the economy. With such tunnel vision, the notion of any aspiration to universal education becomes as superfluous as the *universitas magistrorum et scholarium*. It is a far cry from any notion of reflecting on society, or of creating spaces for pure research and thinking. It would seem that no institution may be allowed to exist that might evade the supposed laws of the market. We have to [...] defend the university against this. It has already proven that it can produce the ideas, impulses and people needed to create the world of the future – and has done so in a manner very different from the so-called think-tanks of our commercial associations.

Prof. Hans-Rudolf Meier, Bauhaus University, Weimar

Corrigendum

The chip on p. 43 (Horizons 110) works at –273.15° Celsius, not at –275° Celsius as stated erroneously there.

Epidemiologist is the new president of the National Research Council

Manu Friederich



Matthias Egger has been appointed as president of the National Research Council of the SNSF. He was elected by the Executive Committee of the Foundation Council of the SNSF for the 2017–2020 term of

office. Egger, 59, is a professor at the University of Bern and a public health expert. He will succeed Martin Vetterli, who will become president of EPFL next year. Egger has been the director of the Institute of Social and Preventive Medicine (ISPM) at the University of Bern for the past ten years. He has been a member of the National Research Council since 2010 and is therefore well acquainted with the SNSF and its tasks. Egger is also a member of several faculties and international scientific committees and has received numerous scientific honours in Switzerland and abroad. He will now step down as director of ISPM, but remain active in his own fields of research.

Prize-winning science journalism

JPR Media



The Prix Média 2016 of the Swiss Academies of Arts and Sciences has been awarded to Lison Méric (RTS) for his TV report on people who hear voices. The Prix Média Newcomer has been awarded to Julian Schmidli and Timo Grossenbacher from the data team of SRF, the Swiss broadcasting company, who undertook a systematic investigation of the sometimes problematic, vested interests of Swiss universities. The prizes are worth CHF 10,000 each.

Promoting a scientific culture in the media

The Swiss Academy of Medical Sciences (SAMW) has published a position paper

on improving our scientific culture and on the lack of young people entering the medical sciences. Its recommendations to institutions include implementing rules for 'good research practice', only publishing validated data, and allowing access to original data. It also recommends furthering young talent in a gender-appropriate manner that does not focus solely on publications as proof of achievement. "Culture of research and support for young scientists in medicine" is available online at samw.ch/en.html

The most beautiful images of research

Atelier Cana



The SNSF is launching a photographic contest to uncover the beauty hidden behind research. Scientists working in Switzerland can choose to submit images under one of four categories: the object of study, research locations and tools, the men and women of science, or videos. The prizes will be awarded during the Photo Days in Biel in May 2017, when the works will also be on display.

The SAHS has a new president

Christine Strub



Jean-Jacques Aubert is the new president of the Swiss Academy of Humanities and Social Sciences (SAHS). Having served as vice-president up to now, he will succeed Heinz Gutscher who stepped down in June. Aubert was

appointed a full professor of classical philology and ancient history at the University of Neuchâtel in 1996. From January 2014 to July 2016 he was vice-rector for academic affairs at the University of Neuchâtel. Besides his academic work, Jean-Jacques Aubert has also been active in politics, serving as general councillor and as a municipal councillor in Rochefort (canton of Neuchâtel). He is currently a member of the Great Council of Neuchâtel for the Green Party.

Horizons

The Swiss magazine for scientific research is published quarterly in German and French. This issue is exceptionally available in an English printed Edition. Volume 28, No. 111, December 2016. www.snf.ch/horizonte

Publisher

Swiss National Science Foundation (SNSF)
Communication Department
Wildhainweg 3
PO Box
CH-3001 Bern
Tel. 031 308 22 22
abo@snf.ch

Swiss Academies of Arts and Sciences
Haus der Akademien
Laupenstrasse 7
PO Box
CH-3001 Bern
Tel. 031 306 92 20
info@akademien-schweiz.ch

Editors

Daniel Saraga (dsa), Chief Editor
Florian Fisch (ff)
Pascale Hofmeier (hpa)
Marcel Falk (mf)
This Rutishauser (tr)

Graphic design, photography

2. stock süd netthoevel & gaberthüel,
Valérie Chételat
Illustration: Gregory Gilbert-Lodge

Translation and proofreading

Max Crisp, Chris Walton, Interpreters' and Translators' Association, Zurich

Printer and lithographer

Stämpfli AG, Bern and Zurich
Climate neutral, myclimate.org
Paper: Refutura FSC, Recycling, matt
Typography: FF Meta, Greta Text Std

Distribution

39,000 copies in German,
17,000 copies in French,
3,700 copies in English.

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ISSN 1663 2710

Subscription is free. Distribution of the paper version is usually restricted to Switzerland and foreign organisations.


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

The SNSF

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

The Swiss Academies

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



"It's not algorithms that are at fault
but the way they are used"

Mouloud Dey page 9

"In Switzerland, the history of
decolonisation is less politicised
than it is elsewhere"

Alexander Keese page 29

"I believe that art and science
are related"

Sandra Kühne page 48

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