Science: Colourful stories on the Internet are reaching millions page 25

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Men, women and all the others

The anthropology

The people without The hype around

Gender is a continuum

Hardly has a woman announced that she's pregnant, when she and her partner have to hear the question: 'Is it a boy or a girl?' This desire to know our biological gender is bound up with how we are assigned our roles in society. And this influences not just the development of our identity, but also many other aspects of our lives. Society remains rigorously oriented to the poles of masculine and feminine, and we can observe this everywhere – from the signs on public toilets to the different level of insurance premiums we pay until we retire.

However, this dual classification does not always correspond to biological reality. While still in the womb, our genes determine which hormone cascade will be triggered to develop our reproductive organs. The result of this complex process is a female, a male or a variant of biological gender otherwise known as hermaphrodites, intersexuals or persons of ambiguous gender. Estimates vary drastically as to just how many people are born into bodies that are neither male nor female. Klinefelter is the most common of these syndromes, and is characterised by the occurrence in boys of an extra X chromosome (thus XXY). Its prevalence rate is reckoned to be one in 1,300.

What is certain is that variations in gender development are far more common than society thinks. One reason for this lack of visibility has been the medical doctrine requiring such children to be assigned an unambiguous gender by surgical means as soon as possible. It is still carried out today in some places - despite the fact that it's only in the rarest of cases that such early surgery is recommended for medical reasons. Since the 1990s, people who suffered such operations during childhood have been trying to put a stop to them. They have also been campaigning for the right to greater self-determination. In France, for example, a 64-year-old person recently acquired the right to a passport stating a 'neutral' gender. In their endeavour to be allowed to decide how they define themselves, they are being helped by transgender lobby groups and by artists who have chosen their own gender identities.



Pascale Hofmeier, editorial board





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Lest we forget

"What molecules are needed to form and maintain synapses?" This is the question being asked by Jan Pielage at the Friedrich Miescher Institute (FMI) in Basel. He and his team mark molecules with fluorescent colours. This makes it possible for us to see the innumerable synapses that are used to transmit nerve impulses for muscle contractions.

The image reproduced here demonstrates what's happening in a gap of a twentieth of a millimetre. The ends of a nerve cell of a fruit fly larva are glowing blue. They are growing on a muscle cell that can't be seen here as it is in the dark. Under the microscope, we can see how synapses are formed between the nerve cells and the muscle cells.

Thanks to the high resolution of their 3D structured-illumination microscope, Pielage and his team can observe the processes unfolding in the synaptic clefts, which are just 200 nanometres across. The proteins on the side of the muscle cells are marked red, while those on the nerve-cell side are green. They are grouped in large numbers within the spherical synaptic boutons in order to create impulses sufficient to activate the muscle cells.

The blue protein links the exterior of the nerve cell with its inner structure and stabilises the synapse. If it is absent, then the end of the nerve cell disintegrates and a trace of red protein remains on the musclecell side. This is probably more or less what happens in patients with amyotrophic lateral sclerosis, a deadly type of muscular atrophy. Pielage's findings can be broadened to apply in part to the brain, he says. "Similar mechanisms control the plasticity of synapses for learning and remembering". *ff*

R. Stephan et al.: Hierarchical microtubule organization controls axon caliber and transport and determines synaptic structure and stability. Developmental Cell, 2015.

Image: Jan Pielage, FMI, Basel

Should we stop manipulating the human germline?

In China, the new CRISPR/ Cas method has been used to manipulate the human germline for research purposes. But shouldn't researchers everywhere respect the human germline until more is known about the possible ramifications?



Genetically modifying the germline is banned today in Switzerland and in many other countries. We know almost nothing about the efficacy and the safety of such interventions, and still less about the long-term effects - intended or otherwise. The experiments with human embryos in China demonstrate just how crude the technology still is. Only in four of 86 cases did the genetic manipulation succeed on a molecular level, and even they were only partially successful. Most of them displayed genetic abnormalities. On the basis of these results, we shouldn't expect to be applying this technique in the near future.

On the other hand, humans suffer from many genetically determined diseases, and we are constantly uncovering more of the genetic causes. How are we supposed to fight these? One possibility is pre-implantation diagnostics. The Swiss federal parliament would like to allow its use in certain cases. Pre-implantation diagnostics – in other words, examining the embryo before it is implanted in the mother – cannot always prevent disease. There's little to be says the stem-cell researcher Dieter Egli.

done, for example, if both partners carry the same genetic defect or if several genetic defects are present at the same time. Another possibility, which we should consider in this light, is a genetic correction to the germline.

"The discussion about manipulating the germline requires more knowledge and more research"

Dieter Egli

We have to learn how effectively and how safely we can manipulate genes in the human germline, and we have to find out whether this is better than other therapies. It's a contradiction in terms to demand that we wait until we know more, yet at the same time to place a moratorium on research. If we want to know more, we have to carry out research. We shouldn't put a brake on it, but promote it within a basic set of conditions. For example, it could be restricted to research for the purpose of healing diseases.

Would this mean opening up a doorway to the genetic improvement of human beings, like some people fear and others hope? I'm convinced that humankind has to face up to such questions, and that we have to regulate the application of these technologies. These discussions are necessary, and they will be all the more successful, the better we know the possibilities and the boundaries of manipulating the germline.

Dieter Egli is an assistant professor at Columbia University in New York. He took his doctorate at the University of Zurich and has carried out research into therapeutic cloning.



The CRISPR/Cas method allows us to carry out far more precise, less risky manipulations of the human germline than any other technology. But even if the efficacy of this technique can still be improved, there remain risks such as undesirable integration and the emergence of genetic mosaics. So we are faced with the question: should countries such as Switzerland now lift their ban on manipulations of the germline, or should we renounce such experiments all over the world? I'm in favour of the latter option.

Genetic modifications to the human germline affect the development process and every cell of the developing human individual. Furthermore, these changes are passed down to future generations. Are we really ready to take on the responsibility for the genetic profile not just of the emerging individual human being, but also for his or her descendants?

We have to be aware that transhumanists dream not just of healing illnesses by technological means, but also of improving the human race. People could use CRISPR/ Cas to try and achieve such inheritable Yes says the bioethicist Anna Deplazes Zemp.

'improvements'. Before using this technique in the human germline, it must first be clarified how we are going to deal with such aspirations.

"The international scientific community should regulate when using this technology would be considered inacceptable"

Anna Deplazes Zemp

This has to be a global discourse. And trying to achieve that is a very ambitious goal. Representatives of different cultures have different opinions regarding experiments on human germ cells and embryos. We've already had a foretaste of this in the discussions surrounding the experiments by the Chinese group. They manipulated human embryos using the CRISPR/Cas technique, and their experiments were largely criticised in Western, Christian cultures. And yet, for ethical reasons, these experiments were carried out on embryos that were incapable of further development. So even the researchers themselves seem to think that their experiments would be problematical if they were carried out on embryos that could actually develop. This could perhaps provide us with a basis for a global consensus.

The international scientific community should draw up rules - in a code of conduct, for example - that would stipulate when using this technology would be considered inacceptable. Such a code would be afforded the necessary authority if the most important research institutes, funding institutions, journals and conferences insisted on it being upheld.

Anna Deplazes Zemp possesses a doctorate in molecular biology and works at the Institute for Biomedical Ethics and History of Medicine of the University of Zurich. Her current research includes working on the ethics project of the National Centre of Competence in Research 'Molecular Systems Engineering'.



Baptism isn't just about giving a child a name. It's also a ritual for creating a member of society. This also assigns the child a role in that society. The 50 most popular names for boys in Switzerland are all gender-specific. With girls, only one name can be used for both genders. It's No. 38: Lynn.

Photo: Sergey Goruppa/Fotolia.com

XX, XY, XXY, X and the others

Biology knows more gender variants than just male and female. But they're not yet accepted by society or the law.



There's more than man and woman

Human sexual development is a process that is genetically controlled in the womb. If it's disrupted, divergences occur. *By Irene Dietschi*

alliope is the main character of Jeffrey Eugenides' Pulitzer-Prizewinning novel Middlesex (2002), and the drama of her life revolves around an inherited genetic defect. She is a seemingly normal girl, but during puberty she notices that she is becoming increasingly different. A specialist is given the task of solving her 'problem' by surgical means, but Calliope is given a glimpse of her medical records shortly before the operation is to take place. Here, she reads that her karyotype is 46/XY and she realises the truth: "I'm a boy".

"It's a wonderful book" says Anna Lauber-Biason, Professor of Endocrinology at the University of Fribourg. "Besides its literary quality, it offers a good, comprehensible introduction to the topic of intersexuality". She refers to Eugenides' novel in her lectures - though the word 'intersexuality' is no longer considered correct today when referring to those of ambiguous gender. The medical world tends instead to speak of disorders, or differences, in sexual development - 'DSD' for short.

So what exactly happens, in biological terms, when something goes awry with sexual development? Lauber-Biason explains that human sexual development takes place in three main phases. The first involves the chromosomes, the second the gonads and the third the reproductive organs. The process begins at the moment of procreation, when 23 chromosomes each from the egg and the sperm come together to form a full set of 46, including the two sex chromosomes: 46/XX for a woman and 46/XY for a man.

Three sex chromosomes

"But this process is prone to error. Maldistribution or failed pairings can occur", explains Lauber-Biason. The known anomalies that affect the sex chromosomes include Klinefelter syndrome, where there is an extra X chromosome (karyotype 47/ XXY). It's thought to affect 1 in every 650 male new-borns. Those affected are infertile, have small testicles and sometimes female body proportions; they also produce too few male sex hormones. The chromosome set 45/X is also relatively common - in other words, when a person has a single X chromosome. In many cases it is responsible for spontaneous abortions. 98 percent of foetuses with this karyotype die in the womb, and if a foetus is indeed born, then this karyotype can cause Turner syndrome. The girls who are affected are small in stature, have no functioning ovaries and don't develop breasts unless they are given hormones.

"When anomalies occur, we can only determine the genetic reason in about 50 percent of cases"

Anna Lauber-Biason

When there is a normal chromosomal distribution of XX or XY, the sex is genetically fixed. At the beginning, however, the embryo is a hermaphrodite – the sex glands, or gonads, that form between the

third and seventh weeks of pregnancy are initially identical in both male and female embryos. They only start to differ after the seventh week of pregnancy. Female embryos form ovaries, while males form testes. This development is steered by a whole series of different genes in each sex (see the graphic). But this process can also be affected by mutations. "We know the main gene that is involved in the development of the gonads, but when anomalies occur, we can only determine the genetic reason in about 50 percent of cases", says Lauber-Biason.

A fragile hormone cascade

A hormone cascade is responsible for subsequent developments. In the male foetus, the SRY gene is indispensable. This gene lies on the Y chromosome and encodes the TDF protein (the 'testis-determining factor'). It is this gene that is primarily responsible for the development of the male. Together with other genes, SRY controls the development of the testes, which already excrete large quantities of testosterone while in the mother's womb. It is under the influence of this male sex hormone that the internal reproductive organs of the male develop (the prostate, the sperm ducts and the epididymis), as do the external genitalia (in other words the penis and the testicles).

This cascade is also liable to disruption. A mutation in the gene for the androgen receptor can mean that the male hormones are absorbed only inadequately (or not at all). "This androgen resistance means that the male genitalia do not develop properly in the womb; instead, to all outward

How gender develops

This complex process is prone to error: gene mutations or a maldistribution of chromosomes can impair sexual development. *By Valentin Amrhein*



appearances, a girl is then born with female genitals", says Lauber-Biason. Those affected often don't notice that something isn't right until they reach puberty and find that menstruation does not occur.

When gene control fails

During the course of pregnancy, various genes in the female foetus switch on and control the development of the internal and external reproductive organs. These include WNT4, whose significance for female sexual development was determined by the research of Lauber-Biason and her group. They were able to demonstrate that WNT4 is elemental to the development of functioning ovaries. A defect in WNT4 means that the ovaries of the girls affected produce a surplus of male hormones and are barely able to form egg cells.

"The 'female-by-default' theory is a mistake"

Anna Lauber-Biason

For Lauber-Biason, WNT4 also helps refute the 'female-by-default' theory proposed in the 1950s – according to which the human organism is essentially female as long as it has no Y chromosomes. "There have to be two X chromosomes for a complete female organism to be formed", she says, "and it needs the genetic control exercised by WNT4 in order for the ovaries to function properly".

Lauber-Biason's group recently made another contribution to the genetic jigsaw puzzle of sexual development in humans, by explaining the significance of the CBX2 gene. A mutation in foetuses with a male genotype leads to complete feminisation; furthermore, this gene seems to be involved in developing both the testes and the ovaries. Lauber-Biason discovered this mutation in a patient who seemed to have testes in her abdomen. "But when these 'testes' were supposed to be removed surgically, they proved to be ovary-like gonads so they were left where they were", relates Lauber-Biason. However, CBX2 anomalies are extremely rare, just as is the case with WNT4 mutations.

Doctors more frequently find the socalled adrenogenital syndrome in genetic females. This is a metabolic disorder that is inherited. "In this syndrome, female foetuses are exposed to large quantities of androgens that are formed in the adrenal cortex, meaning that they are born with masculinised genitals", explains Lauber-Biason. These girls have a normal uterus and normal ovaries, but a clitoris that in some cases resembles a penis. They also lack a vagina, and the large vulva looks like a scrotum. Boys can also have this disorder, though they display different symptoms.

And what is Calliope's problem in "Middlesex"? She too suffers from an inherited metabolic disorder, as a late consequence of an incestuous relationship of her grandparents. In her case, her androgen receptors were inadequately stimulated in the womb. Typically, the feminine characteristics of those affected disappear during puberty and they take on an increasingly male appearance. When this happens to Calliope, she runs away from home and lives thereafter as a man, and this is exactly what many do in real life. Cal, as he henceforth calls himself, is already over forty when he falls in love with a woman photographer and reveals himself to her. And she accepts him as he is.

Irène Dietschi is a freelance journalist in Olten.



"There's a very broad spectrum"

The fact that we insist on unambiguity in matters of gender is the result of historical conditioning, says the gender researcher Andrea Maihofer. But these fixed norms are starting to become more fluid. *By Susanne Wenger*

Professor Maihofer, one of the first questions we ask when a child is born is: 'Is it a boy or girl?' Why do we want to know this straightaway?

Andrea Maihofer: Because our society is still organised along the lines of a heterosexual, gender dualism. Every individual that is born has to be identified immediately as either male or female, even if it's not so clear – as in the case of some intersexual children. Right from the start, we treat kids so that they are given a gender identity that is as clear-cut as possible, one that is easily recognisable by others. If we meet someone we can't pigeon-hole easily as a man or a woman, it bothers us.

What's your explanation for that?

The reasons are cultural. Bourgeois society developed the notion of a natural, hierarchically structured, heterosexual gender duality with clear differences between women and men. But societies have also existed that were less binary in their orientation. In the 15th and 16th centuries, not so many gender differences were made when dressing small children from the upper classes. Girls and boys were dressed similarly and adopted similar physical postures. You can find a lot of pictures in museums to prove this.

Gender is regarded as a natural characteristic. What's your opinion on this as a gender researcher?

It wasn't so long ago that women were judged to be incapable of coping with a university education. It was said that their very nature made them unable to think rationally, and that they were too emotional for careers as doctors, judges or suchlike. Today, women often get better academic results than men and there are more and more female doctors and judges. This clearly refutes any claim that 'nature' makes all this impossible. Nevertheless, people keep on claiming that there's a natural difference between the genders. Gender research tries to demonstrate that this mind-set is being constantly recreated, and that it has an impact on the socialisation of individuals. Just look at children's advertising, where girls and boys are addressed in an extremely different manner. This all contributes to the perpetuation of a binary gender system. It's a complex circle.

"If we meet someone we can't pigeon-hole as a man or a woman, it bothers us"

Ethics commissions advise us not to operate on children whose gender is unclear. Transgender lobby groups are fighting for their rights. In the media, we see artists who have chosen their own gender identities. How does all this fit in, do you think?

In historical terms we are living at a time when more and more people are refusing to live out the heterosexual gender dualism that has been dictated to them. It corresponds neither to their actual bodies, nor to their attitude to life nor to their sexual self-understanding. We are dealing with an increasing plurality in our modes of existence with regard to gender and sexuality. There are transgender people who want to live unambiguously, but not in the gender into which they were born. There are people who withdraw from any such unambiguity. And there are others who want to stage a very stereotypical masculinity or femininity. Today, there's a very broad spectrum.

Is society ready to accept this development?

I think it's important that society creates a situation that allows people to live out this plurality without discrimination.



Intersexual children should not be operated on, says Andrea Maihofer. © All rights reserved

Operations on intersexual children are rightly regarded as an abuse of their human rights today. In Germany, people who wish to change their official gender are no longer required to be operated on or to take hormones. They do have to produce references proving that they will only be able to live out their real gender if they are allowed to change it. But they don't have to alter their physical body at all. That's a huge difference from how things used to be.

Susanne Wenger is a freelance journalist based in Bern.

Gender

The philosopher and sociologist Andrea Maihofer is a Professor of Gender Studies and Head of the Centre for Gender Studies at the University of Basel.

Enforced silence

For a long time, the medical profession has been keeping quiet about people whose biological identity strayed from the norm. And change is only coming slowly. *By Antoinette Schwab*

here is nothing new about children being born with ambiguous gender traits. They used to be called hermaphrodites, and later 'intersexuals'. The latter term is misleading, however, because it incorporates the word 'sexual'. To be more precise, "'intersexuality' refers to bodies, and in some circumstances to illness. It doesn't primarily refer to sexuality or sexual orientation", says Jürg Streuli, a doctor and medical ethicist from Zurich. For this reason, the abbreviation 'DSD' has been in use for a few years now, meaning 'Disorders of Sex Development' (or 'Differences of Sex Development').

The damage done by desiring clarity

From the 1950s onwards it was customary for DSD children to be assigned a gender as soon as possible, and for them to be surgically operated so as to adjust them to this chosen gender. This practice goes back to the sex researcher John Money in the USA. People with DSD had been operated on before this, but now it was given a theoretical basis and carried out systematically. It was in this context that Money standardised the use of the word 'gender' to signify one's sexual identity in society. He was convinced that you could turn anyone into anything, as long as the environment was constructed accordingly. In order to make this easier, the appearance of the genitalia had to correspond to the gender to which one was assigned. So the genitalia had to be corrected as soon as possible after birth. Every child born with DSD was consequently treated as an emergency, even if this wasn't the case in a medical sense. As a result, children underwent unnecessary cosmetic operations that could have been done at a later date, had they been desired. Some of those who experienced these operations in their childhood have described them in interviews and autobiographical reports as 'torture', 'genital mutilation' or even 'child abuse'.

Secret diagnoses

Those affected have found the silence enforced around them to have been at least as bad as the operations themselves. Their patient records bore the instruction: "The patient is not to be informed about this diagnosis". That, too, was Money's idea. The child should not be allowed any doubt about its gender. It had to endure surgical operations to the genitals - the clitoris was shortened or even amputated (or was it in fact really a penis?) and a neovagina was created that had to be stretched constantly. Initially, a metal rod was used for this; later it was made of plastic. And to avoid the supposed danger of cancer occurring, testicles and ovaries were also often removed. It was a paradoxical situation. For on the one hand, the children had to endure doctors, students and nurses peering between their legs at regular check-ups, but on the other hand, no one was allowed to say anything about it.

Most of those who speak out today only became aware of their diagnoses by accident. The stories they tell in Internet forums often sound similar: stories of pain and drugs without any explanation as to why these were necessary. Stories of shame, and of feeling afflicted by some possibly monstrous disease. Some even had to endure the public revelation of their diagnoses. When sex tests began to be carried out in sports, some female athletes were found to possess male chromosomes even though they had no idea about it at all. Such tests were sometimes evaluated by the very same institutions that had advised silence on the diagnosis of DSD in children.

Stopping the operations

It took a long time for people to start arguing against surgical gender assignment - and the reason for this probably lies precisely in the fact that people with DSD were kept in the dark about it for decades. It was not until the early 1990s that those affected began to protest against what had by then become a standard treatment. Their resistance became stronger when it was revealed in 1997 that Money's textbook example - the so-called 'John/Joan case', to which doctors all over the world were still referring - had long been a failure. The boy in question had been surgically altered to assume a female gender at the age of two, but had switched his gender back at the age of 14, living from then on as 'David'. He committed suicide in 2004.

"Intersexuality refers to bodies, not to sexual orientation"

Jürg Streuli

Daniela Truffer is from Switzerland, and she also only found out her story when she saw her medical files – by which time she was 35 years old. She was born in 1965 with male chromosomes but indeterminate genitalia and was then surgically operated upon to become a girl. It was the wrong decision, as a doctor later noted in her medical files. But that recognition came too late for her: "My original physical state has



been lost irretrievably", she has written on her blog: "They took my dignity from me". She found out on the Internet that there are others who had undergone similar experiences. In 2007, Daniela Truffer founded the human rights group 'Zwischengeschlecht.org'. Since then she has fought to have these operations stopped and has also been campaigning for the physical and mental integrity of children with DSD to be respected. She is convinced that many of these children are still being subjected to surgery today, and that children and parents alike are being inadequately informed.

Her group also offers advice to activists abroad and has already achieved success in several cases. For example, the Zurich Children's Hospital had played a pioneering role in treating DSD in the 1950s, but in 2014 it initiated a medico-historical study to evaluate the treatment of people with DSD. This will be the first-ever study of its kind in the world.

Recognising suffering

The National Advisory Commission on Biomedical Ethics has also been dealing with this topic at the express request of the Swiss Federal Council. In a statement in 2012 - which is probably unique in the world - the Commission recommended that any decisions on treatment in the realm of gender determination should only be made when the persons affected are able to make those decisions for themselves. After a birth, parents can be in a confused or desperate state of mind and thus often want a quick decision; but this is precisely what should not be allowed. The Commission's first recommendation on their list of 14 points runs as follows: "The suffering that some people ... have had to experience because of past practices must be recog-nised by society".

Today, clinics are more reticent. Some operations that are not medically necessary are postponed till later. Children and parents are better informed, and in the Zurich Children's Hospital, for example, the team that decides on treatment includes representatives not just from the different medical areas but also from the fields of ethics and psychology. However, no overview exists of what operations are being carried out, or where. And to the present day, the recommendations of the Advisory Commission have not been turned into a binding regulation. The Federal Council intends to reply to this position paper by the end of 2015.

"The suffering that some people have had to experience because of past practices must be recognised by society"

National Advisory Commission on Biomedical Ethics NEK-CNE

The topic is also being discussed at the UN. No less than three UN committees have commented on the Swiss situation in the space of a single year. Under the title "Harmful practices", the Committee on the Rights of the Child expressed its deep concern about the surgical operations. The Human Rights Committee has asked for statistics, and the Committee against Torture has noted that neither sanctions nor reparations have been made, and it further recommends that all necessary measures be taken to guarantee the integrity and selfdetermination of those affected in future.

Antoinette Schwab is a freelance journalist in Bern.

www.intersex.ch (self-help)

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Man or woman – by official consent

Swiss law assumes that there are men, women, and no one else. But in purely legal terms, other options are perfectly possible. *By Susanne Wenger*

n the eyes of the state, we can remain nameless for a maximum of 72 hours, and for the same length of time we may remain devoid of gender. But within three days of its birth, a baby has to be registered with its full particulars. That's what the Civil Registry Ordinance demands. "Gender may not be left open", says Andrea Büchler, the Chair of Private Law and Comparative Law at the University of Zurich. The Civil Registry only knows male and female. Büchler calls this the "legal compulsion to unambiguousness". This gender dualism can be traced through the whole of the law, from maternity insurance to compulsory military service to marriage and quota regulations. The law, says Büchler, is founded on certain assumptions: that gender can be determined clearly, and that gender identity corresponds to the physical body. These supposed certainties are upset by people whose bodies are between the sexes, and by transsexuals who wish to live in the opposite gender. "Transgender identities bring into question the very fundamental convictions of the law".

Changing one's official gender at a later date is a correspondingly complex process - even though the jurisprudence reflects a cautious degree of liberalisation in this respect. A judgement made by the Zurich High Court in 2011 is regarded as a milestone in this field. The Court allowed a change in the Civil Registry from male to female, even though no sex-change operation had taken place. Despite this, the judges ruled that the necessary requirement of the change being irreversible had been fulfilled. The person had achieved her "desired female gender", and hormone treatment had rendered her infertile as a male. Büchler finds this an interesting point regarding sex changes, because a man who

used to be a woman can't bear children either. It is simply impossible to avoid fixing oneself in a specific gender. "Whoever would like to avoid it simply comes up against the boundaries of gender categorisation that are set by law".

Do we need two genders?

Other countries go about these matters with a greater degree of differentiation. Since 2013 it has been possible in Germany to omit stating the gender of children who at birth are not unambiguously either male or female. The Süddeutsche Zeitung wrote of a "revolution". In Australia, intersexuals can place an 'X' in their passport where they are otherwise required to state their gender. In 2014, the Indian Supreme Court recognised the transgender hijra communities as a neutral, third gender with access to minority rights.

"Transgender identities bring into question the very fundamental convictions of the law"

Andrea Büchler

In Switzerland, it does not seem practicable to offer a third category. In 2012, the National Advisory Commission on Biomedical Ethics argued in favour of the right to self-determination among people of divergent sexual development. But it refused to recommend introducing a non-specific category, claiming that those affected would only be stigmatised all the more because gender dichotomies are "deeply anchored in our society and culture". As a compromise, ethicists now recommend making it easier to change the gender entry in the Civil Registry, and making legal proceedings unnecessary to bring about such changes.

Nor is Büchler much convinced by the idea of a third category: "Such a catch-all solution could not do justice to the sheer variety of transgender identities and of physical gender traits that exist". She thinks we should instead be asking if the law really needs the category of 'gender' at all. Categorisation is in itself injurious to the personal rights of those who do not fit the binary gender order: "Young people are often under great mental pressure, and they would be free of their burden if we were no longer officially registered as either male or female".

Why should the state be interested in our gender at all? This is Büchler's radical question, and it is one that is bound to provoke controversy. But in pragmatic, political terms, not even a less radical solution has a chance of becoming a matter of priority. When a proposal was made to the Swiss Federal Parliament in 2013 that children of uncertain gender should not be entered as either male or female in the Civil Registry at least until adulthood, it was dropped without even being discussed.

Susanne Wenger is a freelance journalist based in Bern.

Büchler, Andrea; Cottier, Michelle (eds.): Legal Gender Studies – Rechtliche Geschlechterstudien. Eine kommentierte Quellensammlung, Zurich 2012.

INTERVIEW

"You have to be able to read it in the bath"



Corinna Virchow, who holds a PhD in German studies, has just launched a magazine for the humanities called Avenue. The publication is a partnership with Mario Kaiser and is due to appear online and in print.

How is Avenue innovative?

It will address the humanities as a whole, rather than just being about history, psychology or philosophy. This approach is lacking in the German-speaking world. The current choice of magazines often shows scholarship and science as a grouping of immutable facts into articles. These sometimes come across as compendiums of guidelines. We feel we're much closer to scholarship, and we want to show how it's a continually evolving process.

How will you do that?

Our websites allows readers to leave comments at specific points in an article. This promotes a factual discussion, based on specific arguments. What's more: there's no need to sign up, you just have to leave your e-mail address. We wanted to avoid the trap whereby general debates take place underneath online articles and diverge quickly from the subject at hand. Authors are able to reply and then we decide which articles will go into print.

Who is writing the articles? Researchers, off-campus scientists and journalists. Then we'll be the ones getting our hands dirty on the editorial side of things, because we want articles that can be understood in 10 minutes. You have to be able to read Avenue in the bath! A magazine is a thing of beauty. We're aiming for "Brad Pitt with spectacles", a blend of intelligence and beauty.

What is your business model? We were able to raise start-up money, but in the longer term we'll be counting on advertising income and subscriptions to the print magazine. We're still negotiating distribution with the major Swiss publishers, and we are also thinking about guerrilla marketing. Furthermore, we are going to create ads based on extracts from the magazine and place them at bus stops. That's the ideal time to connect with people's minds, isn't it?

What will be the topic of the first issue? Cyborgs.

www.avenue.jetzt

NEWS

Less social science in Japan

On 8 June 2015 the Japanese government delivered a shocking announcement: 86 national universities have been called to undertake "steps to abolish organisations [active in the human and social sciences] or to transform them so as to serve the needs of society better". According to the blog Social Science Space and the newspaper Yomiuri Shimbun, 26 institutions have said they are ready either to reform the programmes or to cap intakes. The Science Council of Japan has published an open letter expressing its protest.

The journal of preprints

The idea is so simple it needed a genius to implement it. Using Discrete Analysis, the mathematician Timothy Gowers, UK, has launched a 100% open-access journal. Manuscripts must first be submitted to the prepublication server Arxiv, ensuring they are widely accessible. There they undergo peer review before being officially published or not, as the case may be. The cost will be \$10 per publication, which for the moment will be paid for by the University of Cambridge.

Science in exile

There are multiple European initiatives to support refugee scientists or to profit from them. The EU platform Science4Refugees allows CVs and job offers to be placed online. In Germany, Change for Science is centralising offers such as access to libraries or courses. Silent University is working as an exchange platform for exiled scientists. And the British organisation Cara is offering scholarships to researchers who are in immediate danger in crisis countries and supporting their visa applications.

THREE QUESTIONS

"You need both the carrot and the stick"



University programmes for self-archiving scientific publications ("green open access") often don't work. One exception is the University of Liège in Belgium. Here are some insights from its former d Bentier.

Rector, Bernard Rentier.

Does your archive really work?

87% of our institution's scientific articles from the period 2011 to 2013 are available in our archive. And we regularly verify that these are the full texts. Anyone whose work is missing receives a punitive letter from the Rector.

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How did you succeed?

First of all, we put in place a rule requiring researchers to archive their articles. Above all, however, the University now only evaluates internal finance requests and career promotions on the basis of articles in the archive. It is therefore in the interest of researchers to keep it up to date. We also highlighted the advantages, such as enabling alternative statistics (downloads, etc.). You have to use both the carrot and stick.

And what about copyright problems? Authors must respect any embargo period required by a company publishing their work. For example it may require six months before a manuscript can be submitted to an open archive. Our system, however, allows us - with a single click - to request the author to send the manuscript, which is perfectly legal and effective.



Explaining science

Short, colourful and irreverent

In the digital sphere, people tell research stories differently. Popular posts in the digital village can reach several million readers. *Text: Roland Fischer Layout: Bogsch & Bacco*

ho explains science? New science channels are being established on the Internet, in blogs and social media, and they are reaching the younger generation through the mainstream media's back door, as it were. These channels are often run by newcomers and scientific amateurs with personal passions for their topics and a sure feeling for how the attention economy functions. The Net loves the easily digestible products of laboratories and classrooms - unbelievable experiments, crazy scientists, cute biology and jokes about chemical bonding.

Consequently, there's a vigorous debate going on today about whether this is an opportunity for 'real' science, or a threat to it. One way or another, future generations are automatically going to be given a more open picture of what science is about. Here we offer three sketches of science communicators typical of the scene.

>>>> www.youtube.com/crashcourse >>>> www.facebook.com/IFeakingLoveScience >>>> www.periodicvideos.com >>>> www.youtube.com/Vsauce >>>> www.facebook.com/pornscience >>>>



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The Facebook phenomenon Elise Andrew

26 years old Midland, Canada facebook.com/IFeakingLoveScience 22 million likes Andrew from England began to feel she was swimming against the current. But she can't complain, because thus far she's largely been riding on the crest of a wave. In 2012, at the age of 23, she launched a Facebook page that went on to gain a million 'likes' in just six months. Today, Andrew reaches more people through social media than the readership of Popular Science, Scientific American and the New York Times put together. And she's done it with the most unlikely of topics: science.

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I Fucking Love Science (IFLS) is a Facebook phenomenon. Only few such pages have experienced such swift growth in recent years. So it's not surprising that this phenomenon and the woman behind it have become the target of criticism, both in the science world and outside it. The reaction of the digital sphere became really disconcerting when Andrew set up a personal Twitter channel and uploaded her profile picture. The revelation that one of the most successful science channels was curated by a young, good-looking woman caused plenty of comment.

A shy star

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Criticism of the IFLS boss took on more substance recently. She's a newcomer in many senses – while she has a degree in the natural sciences, she has never had any training in communication or journalism – and researchers began to accuse her of being a 'bargain basement' for science facts and of trying to entice people to her site by giving sensational titles to her articles. And it's true that last spring, IFLS managed over the space of several days to warn of an imminent new ice age, then to dismiss this warning as baseless, and then to blame the media for always dramatising everything. Andrew made no reply to the criticism levelled at her, and in fact since IFLS became so successful she has been relatively shy of publicity. Nor was Horizons able to reach her for comment. But writing on Facebook last March, she did make it clear that she doesn't have a high opinion of journalism. "I'd like to see traditional media being bypassed. I'd like to see scientists engaging directly with the public", she wrote. These are not the words of a mere beginner, but of a highly successful businesswoman.

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>>>> twitter.com/50NerdsofGrey >>>> www.youtube.com/minutephysics >>>> twitter.com/AcademicsSay >>>> www.youtube.com/numberphile >>>> bit.ly/VintageSpace >>>> www.scicombinator.co

The explainer Philipp Dettmer

> 29 years old Munich, Germany youtube.com/Kurzgesagt 5 million views per month

"Atoms as big as mountains — neutron stars explained"

"3 reasons why nuclear energy is terrible! 2/3"



urzgesagt' was the name chosen spontaneously by Philipp Dettmer, Stephan Rether and their group of information designers for their Youtube channel. They didn't stop to think about the problems non-German speakers might have with its pronunciation, because their original intention was just to create a private channel for uploading science videos. But then their click counts went through the roof, and soon there was an immense demand for more from the USA and England. They could hardly have chosen a worse name for their site, given that it's so difficult for English speakers to pronounce. So they had to choose an English name to match the German: 'In a nutshell'. Today, most users won't even notice that these videos aren't from one of the big animation film studios, but are in fact produced by a small design office in Munich. They deal with all kinds of topics and have been watched at least several hundred thousand times some of them even reach into the millions. All the same, "we couldn't ever live from this", says Dettmer.



Even a well-visited Youtube channel hardly brings in any money – at least not enough to pay for all the work that goes into one of their five-minute videos. Dettmer writes the scripts himself – and he's a non-specialist too, having studied history before turning instead to information design. Their research lasts between several weeks and several months, and his team invests at least as much time again in the actual animation. "There are no scientists in our team", says Dettmer, but today they can at least call on the help of a whole network of experts.

"Everything you need to know about planet Earth"

The immense amount of attention they get has other benefits. The 'Kurzgesagt' videos are an advertisement for their office's commercial activities, and ever bigger clients are now commissioning work from them – companies such as Dell and Adidas, and even the EU.

But why science? "Out of sheer interest", says Dettmer. The videos are a real labour of love for everyone in the team. Professionals in the communication sector have been somewhat non-committal in their reaction to these newcomers, however, Universities, for example, are not very interested in their colourful little films, at least not in the German-speaking countries. "The USA and England have progressed much further in that sense. They've understood that it's a good thing to put across a topic in an engaging way". In this regard, people in the communication sector in Germany are still very elitist. And inasmuch as things are changing at all, they're only changing "very slowly", they say.



"MEP solar panels"

m >>>> www.facebook.com/EpicLabTime >>>> pnis.co/about.html >>>> www.theonion.com/section/science-technology/ >>>> www.youtube.com/AsapSCIENCE >>>> www.reddit.com/r/science >>>>

"The Ebola virus explained

- How your body fights for survival"

Blogging and slamming André Lampe

35 years old Berlin, Germany scienceblogs.de/diekleinendinge/



ndré Lampe's e-mail address is a statement in itself: theoneandonlylampe@gmail.com. It makes him sound more like an entertainer than a researcher working all alone up in his garret. It smacks of the exaggeration of show business, not of a fidelity to facts. In other words, it's reminiscent of everything that scientists usually want to avoid. And indeed, Lampe has a booming voice well suited to the stage, as is obvious even when you only have him on the other end of a telephone. He's one of the most successful 'science slammers' in the German-speaking world, and he knows how to use his voice too. For several months, this 35-year-old physicist has also been blogging, running the channel 'Die kleinen Dinge' ('The small things') on the 'Scienceblogs' platform. He is also writing his doctoral thesis – and doesn't have a permanent job.

Farbe und das

Fluoreszenzmikroskop /eröffentlicht von André Lan Juli 7, 2015

Lampe is one of the increasingly numerous young researchers who use third-party funds to finance their dream of a long-term research project. They do this because today's science set-up hardly offers any jobs "that leave you enough air to communicate". He lives from his performances as a science slammer and from the fees he charges as a moderator and for giving workshops. He'd like to give more workshops to show other scientists how to communicate scientific content in an easily comprehensible format. His sense of having a mission is obvious when he speaks about it.

Reconstruction

Ich hab was gegen Rauschen Veröffentlicht von André Lampe am September 8, 2015

A man with a mission

While 'slamming' is probably impossible unless you've got ambition and a dash of eccentricity, writing blogs is for Lampe an activity that is more self-sufficient. "I don't measure my blogging success by the number of clicks that my texts generate". And he doesn't earn any money from what he writes. That probably won't change in the future either, even if his blog gradually attracts more readers.

But writing texts regularly is a fantastic way of practising how to communicate with others. And for this reason alone it's something he'd recommend to every colleague. Nor does Lampe mince words when he talks about science's ivory towers: he thinks it's "deadly" when scientists only write specialist articles for their peers to read. Ideally, he says, all research findings should be offered in a form that's easily comprehensible to those on the outside. Every researcher ought to make sure that his findings are communicated to others, he thinks – though of course, not everyone is suited to performing on stage. A blog is a good alternative. And if this doesn't appeal either, there's always a communications department in everyone's own institution.



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Business for all

A video on the abstract topic of corporate social responsibility receiving 240,000 views? This is a measure of the success of 'Little Green Bags', a series created by the University of St. Gallen with financing from the SNSF's Agora programme. The aim was to show that it is possible to present these topics in a stylish, dynamic way, says Andri Hinnen, creator of the series and founder of the communication agency Zense. "We included a touch of humour and glamour". The audi-

>>>> twitter.com/#fieldworkfail +>>> youtube.com/ERB +>>> www.youtube.com/CGPGrey +>>> phdcomics.com +>>> www.youtube.com/minutephysics +>>> www.youtube.com/thebrainscoop +>>>

ence is mainly students, teachers and employees of large companies. "We thought niche concepts, such as 'digital good life' or 'public value', stood the best chance of being seen,

Veröffentlicht von André Lampe am Oktober 12,

but it turns out that the really successful topics are 'old-hat' like innovation and entrepreneurship, despite having already been covered thousands of times".

VIEW

Thick part of girdle

> hin part of girdle



In academia there's little incentive to engage in interdisciplinary work, says Frédéric Darbellay. And: "It's still a taboo to question the existence of a specialist field". Photo: Sedrik Nemeth

"Risk must be rewarded"

Interdisciplinarity is an entirely separate process that brings university structures into question, according to the expert Frédéric Darbellay. *Interview by Daniel Saraga*

You interviewed 65 researchers active in 10 interdisciplinary research centres in Switzerland. What conclusions did you reach?

Let's start with the good news: Swiss researchers are committed to interdisciplinarity, 'ID'. That said, the majority of them think that it fails to garner recognition as a distinct form of research.

What exactly do you mean by that?

ID often emerges as an approach to broad issues or problems that don't fit neatly into a single discipline, for example those related to education, environment or health. The method therefore usually resembles the problem-solution approach, as opposed to more traditional research, which usually sets out from a specific question emanating from a specific discipline.

The first step in dialogue is being sure of your identity. Do ID researchers worry about losing their academic credentials?

Academic communities are very clearly delimited, and they contribute to the way we define ourselves. Our study shows that researchers don't generally feel fenced in. But they are not all the same either. The 'migrants' move from one discipline to another, such as physicists who study sociology. The 'thematicians' are driven by issues, e.g. gender or cultural studies. And the 'natives' start out in ID.

"Disciplines continue to be a principal factor in scientific identity"

ID appears sometimes to be merely a buzz word, used by researchers to keep management happy.

There's always a risk of being trapped in multidisciplinarity, in other words simply juxtaposing disciplines without creating anything novel. There's more to it than just saying 'we're going ID'. First you have to explain how the theoretical framework is to be jointly created. Then there are the objective evaluation criteria: have researchers developed federating concepts? Which tools did they use to organise their joint work?

What is holding ID back?

It's mainly a structural issue. Each discipline has its language, concepts and specific methods, added to which they each also have a fixed institutional position within a university. Faculties are hierarchical. Some researchers hold things back because ID brings into question not only their power but also the underlying structure of the university. Scientists are the occupying forces of academic territories, and they want things to stay that way. The etymology of 'discipline' has the Latin root 'disciplina', a whip used to discipline oneself or others ...

Is it possible to re-examine the existence of a discipline?

That's still a taboo, because we're talking about a principal factor in the identity of a researcher. It leads to reactions such as, 'why would anyone want to question my area of specialisation?'

Is it difficult to undertake a career in ID? Yes, a career path in ID is often a mismatch with the current academic system. Some ID researchers tell us that during recruitment processes, they have to opt for highly disciplinary profiles. If they are to move forward with their careers, they have to belong to a group of peers, as it's peers who will judge them, publish them and finance them. For now, those on the standard academic trajectory have no incentive to behave differently.

There is dedicated financing for ID, but work needs to be done to ensure universities also make ID careers and training attractive. Risk-taking needs to be rewarded. It's worth noting that a researcher normally has to justify undertaking ID research. But why not ask the opposite: why would they want to restrict themselves to their domain?

You see ID researchers as hackers, why is that?

A hacker is a handyman, able to combine diverse elements in order to change a system from within. The individual disciplines constantly progress by themselves, not least as the result of ID research. In fact, ID is a driving force for transforming the university.

Frédéric Darbellay is a professor at the Centre for Children's Rights Studies of the University of Geneva. He contributes to the position on ID of the League of European Research Universities (LERU).

Reading insects' minds

At work, the biologist Richard Benton is fascinated by the senses of the fruit fly. At home this passionate pianist is responsible for the laundry and the cooking. By Chantal Britt

ost biologists dissect fruit flies at some point in their training. But few are so taken by *Drosophila melanogaster* that years later their eyes still sparkle like a child mastering a new skill. Richard Benton is one of those few. This 38-year-old professor at the University of Lausanne investigates the insect's sense of smell. His curiosity and desire to understand nature also persist when he leaves the campus.

"I often think about insects and their behaviour when I'm outside of work", says Benton. "Why do fruit flies tend to line up on the edge of a cupboard, or why are they more attracted to bananas than apples?" At times he is overly enthusiastic when he shares his reasoning at home, as he concedes: "I just have to look at my children rolling their eyes!" But his wife, Sophie Martin, shares his love for research. Incidentally, she's one of the reasons why he came to Switzerland in the first place. They first met in Cambridge during their PhD studies. Their science later also took them to New York.

From New York to Préverenges

Benton says he could have settled anywhere – in his native Edinburgh, elsewhere in the UK, or in the USA. "But my wife was keen to return to Lausanne", he recalls. "She managed to get a prestigious SNSF professorship in microbiology, and I was also lucky to get an assistant professorship". Their home village Préverenges initially seemed a little too rural as a place to live. "There are still moments when I miss the buzzing 24/7 life of a fast-paced city".

"At the same time our life has changed. I really appreciate having a house with a garden, from which I can easily go hiking, jogging or swimming in the lake". As another convenience, Benton points out having in-laws nearby. "With a young family and a career in science you already end up sacrificing the pursuit of your more intensive hobbies – at least for some time". Benton is a keen cello player and pianist, and his wife plays the violin, but neither can dedicate enough time to practising to be able to join an orchestra as they did in New York. "But that time will come again", he is convinced.

His office - decorated with family photographs and baby T-shirts - prominently displays pictures drawn by his daughter's schoolmates on a visit to his lab. "I like their enthusiasm, fascination and curiosity". Benton himself has preserved a lot of this childlike enthusiasm. Excitedly he picks up an electron microscope image with an oversized head of a fruit fly, and points out the fly's nose.

Protecting vineyards from fruit flies

"They have around a hundred different sensory receptors", he explains. "Although their nose is simpler than our own, odour perception in insects is strikingly similar to how humans smell, when we look at how their neural circuits are organised". His research group dissects fly brains and uses many different approaches to try to understand this fascinating and complex sense - from genetics and imaging to recording electrical signals in neurons and behavioural experiments.

"If we understand how insects detect pheromones and food odours in the lab, we can also try to chemically manipulate the mechanisms controlling their







"We can try to chemically manipulate the behaviour of insects in the wild"

odour-evoked behaviour in the wild". Benton picked *D. melanogaster*, the common vinegar fly that is attracted to rotten fruit, on the basis that this model organism has been studied for over a century and more is known about its biology than almost any other animal.

While *D. melanogaster* is only mildly annoying when it feasts upon rotting produce in our kitchen fruit bowls, a more serious pest is the closely related *Drosophila suzukii*, which lays its eggs in ripe fruit, damaging grape and strawberry crops worldwide, including in Benton's local Lavaux region. If researchers can decipher why this species is attracted to fresh fruit instead of rotting fruit, it might be possible to ward them off crops or to trap them somewhere far from our farms.

"So I may do basic research, but it is only a small step to practical applications. Our findings may not only help us control pests in agriculture, they can also potentially help us to conquer diseases such as malaria, dengue fever and sleeping sickness, which are transmitted by bloodsucking insects including mosquitoes and tsetse flies".

A sabbatical at the lab bench

Benton feels lucky that his job situation has worked out so well. He sees Switzerland as one of the best places for basic research. He praises not only the funding but also the possibility of getting tenure, which offers scientists a stability that is difficult to find elsewhere in Europe.

And Lausanne has certainly grown on him. He likes its quality of life and punctual public transport. Benton is considering applying for Swiss citizenship, and has even taken to skiing. "At the moment my skiing is about as proficient as my French", Benton says with a smile. "But I'm constantly improving and I enjoy it more every year. I certainly have to get better because I will need to keep up with my children on the slopes".

Benton's main frustrations are that he is not able to guarantee his trainees an academic career in science because of a lack of positions, as well as the related problem of gender inequality at the professorial level. He agrees with his wife that it is challenging to juggle child-care and two demanding full-time positions, and thinks that it is essential to avoid adhering to traditional family roles. "My wife is the one drilling the holes and filling in the tax forms at home, while I do most of the laundry and the cooking. And when one of our kids falls sick, we invoke an action plan of who will stay at home when", Benton says. "At work, I wear different hats through-

"At work, I wear different hats throughout the day: I'm a mentor, a teacher, an administrator, and a colleague". But above all, he still considers himself a researcher. Benton's dream sabbatical would be simply to spend time back at the lab bench – for the pure pleasure of doing science.

Chantal Britt is a freelance journalist.

Video interview with Richard Benton: bit.ly/Benton_SNF

A successful nose

Richard Benton (38) has been studying sensory perception in fruit flies at the University of Lausanne since 2007. After his PhD at the University of Cambridge, he also worked at Rockefeller University in New York. He has won several awards, most recently the National Latsis Prize in 2015.

Fishy tales

Simone Häberle's work only starts when the ground plan of old castles has been laid open. This archaeozoologist from the University of Basel can use old fish bones to tell us how Swiss lakes and rivers were used in the past. *By Florian Fisch*

Field work

Filtering

Whenever a Roman kitchen is being excavated, the Basel postdoc Simone Häberle is keen to join the dig. The tiniest fish bones and scales are filtered out by washing buckets of sediment through sieves.



Analysis

Species identification

Out of roughly 40,000 small fish scales and head and spine bones – in the picture to the right they are less than a millimetre across – Häberle can assign about a third to a specific species (or at least a family) within three months. Growth rings can often even enable her to determine the age of the fish and the season when it was caught.



The more proteins fish eat, the greater is their concentration of nitrogen-15. This is why a higher proportion of this heavy isotope is found in older fish and in predatory fish at the top of the aquatic food chain. Furthermore, there are carbon-13 values that are typical of certain habitats.





Interpretations

Nutritional habits

By comparing her findings with historical documents, Häberle can prove that pike were farmed and eaten at Altenberg Castle, the ruins of which sit today in the canton of Basel-Landschaft.

Overfishing

Fish stocks were presumably already endangered in the Middle Ages on account of the intensive fishing of juvenile fish. The proof is found in the high density of young fish in mediaeval latrines in Winterthur.

Water pollution

Did tanneries flush large quantities of organic material into the Rhine even before the days of industrialisation? Häberle would now like to find out whether historical sources can be verified by means of isotope analysis.

The fish trade

A pike found in a Basel latrine of the 15th or 16th century displays an atypical carbon value that corresponds to that of brackish water – which Häberle interprets as proof of trade along the banks of the Rhine.



Whether we look at the road ahead or at our smartphone is decided deep in our brains.

Our focus of attention

The brain constantly has to blank out unimportant sensory information so it can devote its resources to things of relevance. Researchers at New York University have found out how this filter function works by experimenting on mice. One structure in the centre of the brain plays a decisive role in all of this: the so-called thalamic reticular nucleus (TRN), which has long been regarded as a 'control centre' for sensory impressions. Individual neurone groups in it are responsible for turning down each of the senses at any one time.

The researchers exposed the mice to a sound signal and a light signal at the same time. But only one of the signals showed the path to a food reward. This meant that individual neurones in the TRN of the mice brains activated in order to blank out the irrelevant sensory impression in each case. If the researchers deactivated these nerve cells, it became more difficult for the animals to find the food. The same thing happened when they inhibited the prefrontal cortex, which is the part of the brain responsible for making decisions.

"Until now, people thought that concentration was purely a matter for the cerebral cortex", explains Ralf Wimmer, who is currently in New York on a postdoc funded by the SNSF. "And indeed, it does seem to decide where we should focus our attention. But it's the TRN that shifts that focus".

The researchers are now investigating whether flaws in the TRN could be the origin of attention deficit disorders such as those related to ADHD, autism and schizophrenia. *Angelika Jacobs*

Measuring soil pollutants

erbicides are used on many farms to help ensure crop yields. They are also pollutants and a danger to the environment. But because it's difficult to determine the degree of their adsorption and degradation on soil particles, we can't measure if they are broken down in the subsoil, or if instead they reach water catchment areas and enter into the ecosystem.

Now researchers from the University of Neuchâtel, the research institutes Eawag and Agroscope and the Helmholtz Centre in Munich, Germany, are working on a new method to measure the specific biodegradation of herbicides. The method gauges the relationships between different concentrations of element variants, called isotopes. Molecules with light isotopes (such as carbon-12) are broken down quicker than molecules with heavy isotopes (such as carbon-13), so measuring isotopes can help determine the degree of degradation. The greater the degree of degradation, the higher the proportion of heavy elements in the samples.

These isotope analyses have already been successful in laboratory tests to measure the important elements carbon, nitrogen and chlorine. A recently published study has also shown that the researchers were able to analyse four herbicides in a soil sample that they took to their lab.

The project's goal is to refine this method so that it can be used *in situ* in the field, under natural conditions. Environmental authorities and assessors could then be able to predict the risk of groundwater contamination, or develop appropriate monitoring programmes. *Simon Koechlin*

C. Torrento et al.: Fate of four herbicides in an irrigated field cropped with corn: lysimeter experiments. Procedia Earth and Planetary Science, 2015.



The pollutants seep through the piece of soil, are intercepted and analysed.



Methane emissions from cows could be reduced by selective breeding.

Environmentally friendly digestion

fifth of the world's methane emissions come from the stomachs of animals. Wild animals and livestock all emit this powerful greenhouse gas into the atmosphere, both through their breath and through flatulence.

Now a study has shown how these methane emissions can be reduced. The team is led by Marcus Clauss, a veterinarian at the Clinic for Zoo Animals, Exotic Pets and Wildlife of the University of Zurich, and Michael Kreuzer of the Institute of Agricultural Sciences at ETH Zurich, who have been investigating the methane emissions of different animal species. These include livestock such as sheep, cows and horses but also wild animals such as turtles, camels, sloths, kangaroos, pygmy hippopotami and ostriches.

Their results demonstrate that species that eat a lot and digest their food quickly produce a small amount of methane per kilo of food. Species produce more methane when they eat little and digest their food slowly and methodically. However, overall methane production remains the same across all species because the animals with the quicker digestion also eat more.

Nevertheless, the researchers did discover differences within single species. Thus there are individual animals whose methane production per calorie ingested is lower than is the case in others of their species. This is presumably a result of genetic differences, which opens up the possibility of curbing methane production among livestock. "Here, selective breeding could offer us the possibility of reducing emissions", says Clauss. He and Kreuzer estimate that this reduction could be as high as 20 percent. *Atlant Bieri*

S. Frei et al.: Comparative methane emission by ratites: Differences in food intake and digesta retention level out methane production. Comparative Biochemistry and Physiology (2015).

R. D. Wimmer et al.: Thalamic control of sensory selection in divided attention. Nature, 2015.

In the world's biggest democracy

Hans-Christian Baumann spent twelve months working on his doctoral thesis in Delhi. He was investigating the elections there and was surprised by more than just his findings.



I hadn't expected conducting research in Delhi to be so physically strenuous. I went there in 2014 both to investigate the election campaigns of the biggest Indian parties, and to see how the two most important Indian daily papers reported on the election. I was interested in the 'hot' phase of the campaign. But the weather at the time was even hotter still. April to June is the hottest period in Delhi, and it was never less than 40 degrees Celsius. The Cen-

tre for Culture, Media and Governance of Jamia Millia Islamia University is situated in a pretty poor district. There were regular power cuts on account of the heat – and that meant the air-con and the computers also stopped working. That really got on my nerves. I sometimes felt like the archetypal Swiss philistine who gets annoyed at small things. I didn't just suffer from the heat, but from the air pollution too. I rode to work in the back of a three-wheel tuk-tuk



On 27 April 2014, Hindustan reported on Sonia Gandhi of the Congress Party and on the opposition presidential candidate Narendra Modi (photo, left). The two coders (right) helped Hans-Christian Baumann (top) to analyse the content of the newspaper articles. The university is in a relatively poor part of the city. Commuting to work meant navigating traffic jams and streets sodden with rain.

Photos: Hans-Christian Baumann





taxi, and often had to wear a face mask. The journey took 40 minutes on average, but there were days when it took up to three hours. If I hadn't been living in an air-conditioned apartment, I really don't know if I'd have been able to stick it out.

Fighting bureaucracy

"The field work in Delhi was only successful because I'd already built up a good local network on an earlier visit. If you haven't got serious contacts, then there's a real danger you'll be thwarted by the notorious Indian bureaucracy. I also had my fair share of it. In order to register as a resident, I had to report to various offices across the whole town, queueing for hours in the sun. At some point, an official came past my apartment on his motor cycle and brought me my residence permit.

"In democracies, the media play a decisive role in an election, especially the key media. They influence the way the other media report things. In the West, these agenda-setting effects have been well investigated, but not in India, which is the biggest democracy in the world. I wanted to know how the two biggest Indian parties, plus the Hindi-language newspaper Hindustan and the English-language Times of India reported on the two leading candidates: Rahul Gandhi from the Congress Party and Narendra Modi from the opposing Bharatiya Janata Party.

'The fact that I was able to come back with good data was thanks most of all to two Indian Master students whom I employed as coders. I can read Hindi pretty well, but I'm a long way from being able to speak the language fluently. And it wouldn't have sufficed for me to be able to analyse the content of the newspapers and of the election campaigns of the two parties. These two students worked up to eight hours every day for ten weeks in the burning heat, and never let themselves be unsettled by our technical problems. The deal was good for both sides: they were able to earn money and got insights into the scholarly working practices of the West, and I in turn received linguistic and cultural support from them.

An independent press

"I'm astonished at the results I got. Traditionally, Hindustan was the instrument of the Congress Party, while the Times of India was the newspaper of the former British colonial masters. During the election, however, these roots were no longer visible at all. Both newspapers reported very independently and very critically about both candidates, influencing each other in the process. What is noteworthy is that the two parties did not succeed in steering the direction of the media coverage. This actually wouldn't have been so unusual in India, because politicians and private sponsors often try to influence the media there. On the World Press Freedom Index run by Reporters Without Borders, India is very far down the list in 136th place. However, my results are of an exploratory nature and are restricted to the most significant national newspapers and the two biggest national parties. We would need to conduct a lot more research in India in order to be able to understand these effects on regional and

Recorded by Pascale Hofmeier

local levels too".

Art ennobles its owners and art lovers alike: the installation 'Untitled' (1969/2013) by the US artist Doug Wheeler was exhibited at Art Unlimited 2014. Photo: Keystone/Georgios Kefalas

The struggle for art

At Art Basel, sociologists have been investigating how the booming art market is turning the art world upside-down – and at the same time sparking off a competition for social power. By Daniel Di Falco

amien Hirst? Yes, him - the English superstar artist. In 2007 he studded a skull with diamonds and called it 'For the Love of God'. It is said to have cost 14 million pounds to make and was offered on the market for 50 million. But no one wanted to buy it. And in fact, it was precisely this point that made it a success for Hirst - for he was offering the buyer something that actually possessed an intrinsic value, and in the process he quite wilfully drove all the magic out of art.

When a car mechanic draws up an invoice, he lists the cost of his materials and that of his work time. Art, on the other hand, is precious because it is far removed from any such profanely mercantile criteria. Expenses are indeed incurred in the making of it, but this has no real impact on the actual value of the artwork itself.

Franz Schultheis, a sociologist at the University of St. Gallen, has also written about the magic of art and its demystification. But the case of Hirst is of mere anecdotal value compared to the findings of his research group. For over two decades now, the art market has been veritably erupting, says Schultheis, and it is endangering "the traditional institutions of the art world". Collectors, dealers, exhibitors and agents have until now guaranteed the 'charismatic impact' of their commodities precisely by means of a consensus on not referring to them publically as 'commodities'.

The face of capital

But the sociologists have observed just how difficult it has become to maintain that consensus. For the past three years they have been engaging in fieldwork at Art Basel - it is at this trade fair that they have seen the 'mercantile character' of art show its face more openly than anywhere else. And this has also brought out into the open the fundamental contradiction that has dominated the whole art world since Édouard Manet's club of Impressionist artists in the late 19th century. Their declared belief was adopted as the prime ethos of art as a whole: that art exists in a quite separate sphere of its own, standing apart from all laws of economics and society.

At Art Basel, however, capital certainly shows its face. There we find champagne stalls, sponsors' events, and all the feverish excitement of making a sale. The researchers have been documenting the hype and the bustle at this 'carnival' of art with the meticulousness of ethnographers. And they've been investigating its house rules with equal rigour. The VIPs are sorted into different classes and treated according to their economic and social clout; the most potent galleries get the best locations at the fair; and even the art itself is carefully calibrated.What you see most is what sells the best.

There has long been an economics of art. But in years gone by, says Schultheis, it was easier to maintain a 'collective pretence'. Claims about having a 'passion for art' were used as a fig leaf to hide the close relationship between art and capital. In Basel, however, business is centre stage, and when the sociologists start asking questions of the participants, an immense feeling of unease bubbles up. The gallery owners are unhappy because they've been displaced by the big auction houses; the collectors are uneasy because they mistrust the new clientele who are competing for their status; and the artists themselves



are unhappy, with many refusing even to show their faces at Art Basel "because it has nothing to do with art".

Market reactions

Of course, this trade fair actually has a lot to do with art. But just not that exclusive, social arrangement where the participants used to set the price tag on a work of art. This is now endangered by the market itself, which is calling into question the very rules of the art world. Where exclusivity used to dominate, the market now wants to open up, and – like every market – it no longer makes concessions to any 'passion' for the thing in itself. Instead, all that counts is economic potency. It is this "reallocation of power relationships" that has caused the potential losers to turn against the big galleries, against the 'nouveau riche' and against the whole process of commercialisation.

"There's an immense feeling of unease among those involved"

Franz Schultheis

These are the deeper-lying conflicts, and the sociologists are interpreting them by means of the social theories of Pierre Bourdieu. And behind this altercation in the name of 'loving art' there is indeed a competitive struggle going on among the 'ruling classes'. At stake is the symbolic capital that art has long provided: its ability both to add beauty to our walls and to legitimise the societal position of its owners.

Art, says Franz Schultheis, is so valuable because it ennobles the art lover. And it's still more than just merchandise. For this reason, it's unlikely that the market will want to destroy its own magic. The question is rather who is going to control this magic in future.

Daniel Di Falco is a historian and a culture journalist at the Bund newspaper in Bern.

Kunst und Kapital. Begegnungen auf der Art Basel. Verlag der Buchhandlung Walther König, 2015

"The idea of a Great Kurdistan works in a symbolic way"

The war against the Islamic State group may bring the Kurds together only momentarily, according to the historian Jordi Tejel. *By Benjamin Keller*



ome label them "terrorists", others war heroes against the Islamic State. At any rate, the stateless Kurds are fighting a century-old battle for recognition. This summer, the Kurdistan Workers' Party (PKK) took up arms in Turkey against the regime of Recep Tayyip Erdogan, which had started bombing them alongside the Islamic State fighters.

Jordi Tejel is a professor of international history at the Graduate Institute of International and Development Studies in Geneva, where he specialises in the history of the Kurds and other minorities in the Middle East. In his view, it was at the outset that the PKK aimed to unite the Kurdish regions of Turkey, Syria, Iraq and Iran. Today, however, the idea of a Great Kurdistan is principally a justification of the claims made by the Kurds in each country.

Referring to the title of your latest book, how long has the "Kurdish issue" existed?

Since the fall of the Ottoman Empire and the signing of international treaties after the First World War. In 1920, the Treaty of Sèvres set out the creation of a Kurdish state in the south-east of what is today Turkey, encompassing only a small part of the Kurdish territories. The plan was that the Kurdish territories. The plan was that the Kurds in the north of Iraq, who were under British trusteeship, would later be able to join an independent Kurdistan if they so wished. But the 1923 Treaty of Lausanne superseded the Treaty of Sèvres and put an end to the idea of Kurdistan.

What happened?

On the one hand, there were divisions among the European powers. The United Kingdom had notably fallen into competition with France over the Middle East. At the same time, Turkey had led a war of independence against the occupying forces, and on the back of recent victories, Mustafa Kemal (a rebel leader and soon-to-be President 'Atatürk') demanded that negotiations be reopened. On the other hand, divisions had also been growing among the Kurds, and not only tribesmen but also their elders began to align with Kemal against the Europeans.

Why did they do that?

Kemal had promised them autonomy and recognition in the future Turkish state. They were also all united around the practice of Islam and the view of Western powers as infidels. Yet another reason related to the widespread Kurdish participation in the massacre of Armenians during the First World War. Because the elders had encouraged exactions and land grabbing, they had started to fear being judged – and therefore being obliged to surrender territory – under the Treaty of Sèvres, which had provided for an Armenian state.

So what was the European motivation for a Kurdish state?

Between 1918 and 1922 the British were seeking to weaken the Turks and did so by supporting the Kurds, on the basis that they would be easily dominated thereafter. The 1917 Bolshevik revolution had also raised the spectre of a Russian threat, hence the need to create buffer zones.

So finally, neither the Kurds, the Europeans nor the Turks achieved anything.

No. Once Kemal had negotiated the Treaty of Lausanne, he turned his back on the Kurds. All of his promises of Turco-Kurdish fraternity were forgotten. A new programme appeared in its place, based on a united and centralised Turkey. This assimilation plan kicked in as of 1923, becoming the core element for founding the Republic. It was clearly unsuccessful, and things turned out differently.

"Few European countries look forward to the emergence of a Kurdish state"

What do you mean?

The Turkey of 1923 was weak. It needed to be built from the ground up. When Ankara, having recently replaced Istanbul as the capital, decided to impose Turkish as the only official language, the policy couldn't be applied in the majority of the Kurdish regions. In fact, in many Kurdish zones, the Turkish state was almost or entirely absent. Up until the Second World War, this acculturation policy only really had any effect in the cities.

Then what happened?

Starting in the 1940s and 50s, the policy was applied much more globally, particularly on the basis of the growing number of schools, including in rural regions. Military service was also used as a means of integration. It was also at this time, however, that Kurdish nationalism started to re-emerge. Up until then it had all but disappeared following the very forceful repression of the revolutions of the 1920s and 30s, which had pushed Kurdish intellectuals to leave the country.

What was the basis for this renewed nationalism?

The young Kurds who had studied in Istanbul and Ankara became aware of their culture, particularly their gradually fading language. These intellectuals hailed from rural south-eastern regions and so were also struck by Western Turkey being much more well-developed. Although Marxism was permeating through the Middle East at this time, the Kurdish discourse didn't become politicised immediately; instead it mixed cultural claims with Marxist-like statements on development. In fact, many Kurds would first join Turkey's communist and socialist parties.

So when did the breakaway happen?

It was at the end of the 1960s and 70s. The new generation, who felt marginalised, wanted to create their own Kurdish and left-wing parties. This movement was the genesis of the PKK. At the end of the 1970s, they separated entirely from the Turkish left with the idea of creating a united Kurdistan to include all Kurdish regions and adopting a Marxist-Leninist agenda.

"The PKK states that it does not want to question current borders. It does, however, seek the position of regional actor"

So is independence still on the cards?

Officially, the PKK isn't currently pushing for a Kurdish state. They're framing their claims on the basis of today's borders. For some years, the PKK leader Abdullah Öcalan, who is still imprisoned in Turkey, talked of what he called democratic confederalism: a blend of anarchic and democratic principles, based on the decentralisation of power and self-rule, with some feminist and green ideas mixed in.

What are the links between the PKK and the Syrian, Iraqi and Iranian Kurds?

The PKK underwent reorganisation when it was listed a terrorist organisation by Turkey, the United States and the European Union among others. Rather than unite in action on all fronts, the PKK decided to take different names according to the country. In Syria it became the Democratic Union Party (PYD). In November 2013, after troops from Damascus partially withdrew from the Kurdish region of Rojava in the north of Syria, the PYD unilaterally declared the zone to be autonomous and started applying democratic confederalism. The PYD therefore has a privileged position relative to its less-well known counterparts in Iraq, the PÇKD, and Iran, the PJAK.

Does the PKK want to unify the four regions?

I don't think so. The idea of a Great Kurdistan only has symbolic meaning. That goes for all Kurds, and not just the PKK. In each country, they use it to legitimise their individual claims. Proof of this can be seen in Iraq; the Kurds autonomously control a region in the north of the country where talk of 'Kurdistan' refers to that region alone. The PKK states that it does not want to question current borders. It does, however, seek the position of regional actor, i.e., exerting influence on all Kurdish regions so as to gain resources for use in Turkey.

How are the relations between the PKK and the government of the Kurdish region of Iraq?

They are in competition. And one sign of the PKK's edge is the presence of its military bases in the north of Iraq, which are out of bounds to the Iraqi Peshmerga fighters.

Could the Kurds join in the fight against the Islamic State group?

It may reunite them, but only momentarily. In fact, we already saw this happen when the Peshmergas helped the Syrian Kurds defend the city of Kobane, and when the PKK fought the Islamic State to protect Erbil, the capital of Iraqi Kurdistan. After each event, the foreign party withdrew to its own trenches.

Can the Kurds expect recognition from the West?

They don't really have any choice: they have to fight the Islamic State group because it considers them an enemy. They are trying to sell their fight, but they know all too well that the West will turn its back on them as soon as the situation starts to change. For now, there's a lot of sympathy for the Kurds, but few European countries look forward to the emergence of a Kurdish state. Nor do we know to what extent the United States is ready to upset Turkey, given its strategic value.

Benjamin Keller is a graduate of international relations and a freelance journalist based in Geneva and Tunis, Tunisia.

The world's largest stateless population

Some 40 million people call themselves 'Kurds' and therefore comprise the world's largest stateless population. 'Kurdistan' straddles parts of Turkey, Iran, Iraq and Syria, covering more than 500,000 km², (i.e., an area 12 times larger than Switzerland). This territory is not unified, and the degree of autonomy given to Kurds varies according to the country. There is also a huge diaspora outside of the region: between 1.5 and 1.7 million Kurds can be found in Europe, including around threequarters of a million in Germany, according to figures from the Kurdish Institute in Paris, France. Kurds speak their own dialects and are 80% Sunni Muslims.

From Spain to the Middle East

Jordi Tejel is 44 years old and an SNSFsponsored professor at the Graduate Institute of International and Development Studies in Geneva. He works in the international history department where his research covers the history of the Middle East, its minorities and its borders, with a particular focus on the Kurdish issue. He was born in Barcelona and in 1996 moved to Switzerland, where he still lives with his wife and two children. He has published a number of books including *Irak, chronique d'un chaos annoncé* (2006) and *La question kurde: passé et présent* (2014).

Successful comeback after a baby break

ow many new mothers succeed in getting swiftly back into the swing of working life, and how many are happy with it? This has been investigated in a longitudinal project by Bettina S. Wiese, a psychologist at RWTH Aachen University, in which she gathered together the opinions of some 300 women from Switzerland, Austria and Germany. They confirm the role played by external circumstances - such as working hours and work-related stress. But at the same time, it's a woman's personal character traits and abilities that are truly decisive in whether she enjoys a successful return to her job. "Women who believe they can master difficulties successfully, and who show initiative at the workplace, are those who reintegrate quicker", says Wiese.

But some women regret returning to work, as is proven by diary data provided by the women interviewed. This is somewhat more the case with women who return very soon after giving birth. Women are also vulnerable if they easily feel overwhelmed by stress in general. This emotional frailty is one of those character traits that are difficult to keep under control.

It's also clear that young mothers can facilitate their successful reintegration if they prepare their return to work in good time. For example, it's advantageous if they keep up contact with their work colleagues during their baby break, and make an effort to stay up-to-date in their field.

A woman's partner also plays a complex role in this process. A follow-up study is currently underway in which couples are being investigated to determine just how much partners influence the length of the baby break and the mother's workload. *Anne-Careen Stoltze*

Bettina S. Wiese & Michaela Knecht: Socialisation into Organizations and Balancing Work and Family. In J. Vuori, R. Blonk & R. H. Price (eds.), Sustainable working lives. Managing work transitions and health throughout the life course (pp. 87–105). 2015, Springer.



Whether on the left or right bank of the Rhine: from Chur to Malans, the same dialect is spoken.

A new dialect in Grisons

anguages die out and others are born - though this happens much slower than it does with the people who actually speak them. In recent decades, almost unnoticed by anyone, a new Grisons dialect has emerged in the Rhine Valley near Chur. It has been discovered and described by Oscar Eckhardt, a linguist who is himself from Chur. He has conducted oral and written interviews with 150 young people and young adults who live in the region, and has analysed their comments from a linguistic standpoint. A non-native of the Grisons would simply identify this new local 'language' as a Grisons dialect; but a native linguist can discern that it has replaced three dialect groups: one from the right bank of the Rhine that is also spoken in Chur, one from the left bank of the Rhine, and one from the enclave of Thusis. This new dialect can be proven to exist on the basis of phonetic, syntactical and lexicographic evidence. The fact that these three groups - which are hundreds of years old - have made way for a new regional dialect is largely a result of increased mobility, says Eckhardt. It is consistent with his results that only a third of those interviewed responded by stating their place of residence - such as 'Malans' - when asked to describe their dialect. The others simply called it a 'Chur dialect', a 'Grisons dialect', or even just 'Swiss German'. Urs Hafner

Dutch violence in Indonesia

he Netherlands sees itself as a land of tolerance and humanity. For this reason, the Dutch tend to assume that they behaved in a more civilised fashion in their colonies than did the French, Portuguese, Germans and British in theirs. But that was not the case, as has now been shown in the doctoral thesis of Rémy Limpach, a military historian at the University of Bern, to be published next year in both Dutch and German.

From 1945 to 1949, the Dutch colony of Indonesia fought a guerrilla war to gain its independence. During this war, the Dutch army behaved with extreme brutality towards the civilian population, especially on the island of Celebes (which today belongs to Indonesia under the name of Sulawesi). They engaged in mass violence - killing farmers, raping women, torturing prisoners and burning down entire villages. These were by no means isolated cases of excess, and the colonial authorities justified their soldiers' actions by declaring them legitimate on account of 'martial law', 'states of emergency' or 'counter-terrorism'. Limpach offers three principal reasons for this mass violence: the lack of discipline and training among the soldiers themselves, the fragmentation and overburdening of the army, and the escalating cycle of violence that was further fuelled by acts of cruelty on the part of their opponents. On top of this, the Dutch also had a racist image of their enemy, says Limpach. The mass violence of those times remains a taboo topic in the Netherlands to this day. Urs Hafner

Rémy Limpach: Business as usual: Dutch mass violence in the Indonesian war of independence 1945–49, in: B. Luttikhuis et al (eds.): Colonial Counterinsurgency as Mass Violence. The Dutch Empire in Indonesia. Routledge, New York 2014.



Dutch soldiers on Java pose with a group of Indonesian prisoners of war.



The return to work is more successful for a woman who believes she'll cope.

Oscar Eckhardt: Alemannisch im Churer Rheintal. Von der lokalen Variante zum Regionaldialekt (ZDL-Beiheft). Steiner Verlag, Stuttgart 2016. 430 pp. (in press).



Keystone/Science Photo Library/UIG/Dorling Kindersley

The stuff of dreams

After the bluster around graphene, now we have perovskites. In research and industry alike, people are getting excited about this new class of materials. *By Fabien Goubet*

or some years now, growing numbers of physicists, chemists and engineers have been lulled into a trance by the sirens of a new, exotically named family of materials: the perovskites. This group of oxides is to be found at the heart of a wide range of research projects in fields as diverse as they are promising, including solar energy, microelectronics and lasers.

The first mention of this class of compounds dates back to 1839. At that time 'perovskite' referred to the rock calcium titanate (CaTiO₃), taking the name of the Russian mineralogist Lev Perovski. The term now covers a wide range of materials containing two groups of oxidised atoms and featuring the same cubic crystalline structure.

Bespoke material

Its crystalline structure is actually very common. "It's probably the most widely found crystal structure on earth", says Jean-Marc Triscone, a physicist at the University of Geneva. But it's here that things start to become interesting. "By minutely adjusting the base elements, a radical change can be brought to every property of the material", he continues. It's as simple as taking a magnetic perovskite and substituting one of its elements for another. The result is a completely different material, one that in the process may, for example, have lost in magnetism but gained in conductivity. Perovskites can even be combined, giving rise to new materials with unforeseen properties. "It's like Lego: you can stack them up and create new structures. And not only are the new structures perfect, because the crystal components are all identical, but they also take on different properties from the parents".

Physicists harbour the crazy desire of being able to create a 100% bespoke material that can be built on a needs basis. In Geneva, for example, Triscone is trying to assemble different perovskites into an ambient-temperature superconductor (a material though which electric current passes without any wasteful resistance). Others are hoping to fit the particle accelerators at CERN with new magnets based on the superconductive oxides that won Georg Bednorz and Alex Müller of IBM Zurich the Nobel Prize for Physics in 1987. These oxides look much like a stack of perovskites.

"Researchers can modulate and compile materials as if they were Lego"

Jean-Marc Triscone

And these are just some of the multitudinous examples of potential applications ranging from the design of lasers and LEDs to new types of computer memory. Another promising field of application is centred on ferroelectric perovskites, the crystals of which are composed of ions, giving them natural electric polarisation. By applying an electric field, the orientation of ferroelectric domains can be changed, subtly altering the crystal structure of the perovskite. This in turn modifies the thermal properties of the material. The result is an 'intelligent' insulator that can actively compensate for the significant temperature changes suffered by microprocessors and components of satellites and motor vehicles. Nevertheless, "for now the effect has only been observed at very low temperatures of around 80 kelvins [Ed: -193° C]", says Christian Monachon, a Swiss physicist working at the University of California, Berkeley, USA. This is not an insurmountable obstacle, however, "my research leads me to believe that we can obtain materials with variable thermal conductivity, by using barium titanate, for example, which I'm currently studying".

The sun is shining on perovskites

The greatest interest of perovskites lies in photovoltaic applications. In the space of five years, the performance of perovskite solar cells has quadrupled, almost reaching that of silicon cells and therefore heralding change.

But scientists haven't always felt persuaded by this application. "Since the 1980s, researchers have focused on designing lasers", says the expert Jacky Even of the National Applied Sciences Institute in Rennes, France. It was only in 2009 that the marriage of perovskites and sunshine occurred to a team at Toin University in Yokohama, Japan, which then tried to integrate perovskites into a photovoltaic cell. "It was not an idea well-suited to the exceptional properties of these materials", Even says. "They wanted to promote the



This new generation of solar cells based on perovskites was developed at EPFL and achieves a performance of more than 20 percent. Photo: Alain Herzog/EPFL

as Even says, "a car battery contains 8 kg of lead, whereas a square metre of solar panels only has half a gram"!

Perovskites are indeed the stuff that a scientist's dreams are made of, but not all applications will be successful. For every advantage there are at least as many problems. "Perovskites are opening up a fascinating path", says Triscone. "And it doesn't matter if many research projects lead nowhere; it will perhaps only take one to revolutionise physics".

Fabien Goubet is a science journalist for Le Temps.

light-absorbing properties of the coloured solar cells, but the results were weak and the article went unnoticed for years".

This all changed in 2012, when the idea was taken up independently by two specialists in photovoltaics, Henry Snaith at the University of Oxford and his former mentor Michael Grätzel at EPFL. They both started from the concept of a coloured cell developed by Grätzel in the 1990s and entered into competition to design a new type of solar cell based on a perovskite whose oxygen atoms are replaced by iodine or bromine.

"Perovskites have created a new branch of photovoltaics"

Jacky Even

Just as with silicon in classic solar cells, the perovskite absorbs light and transports electric charges between electrodes. Once more the key here is in the way perovskites form modules. A hybrid perovskite combining organic and inorganic groups becomes a photovoltaic material able to absorb 10 times more light than silicon and that can transport electric charges more effectively than classic colours. "This was a real conceptual leap that's led to a new branch of photovoltaics", says Even.

Competing with silicon

Since then, a battle has been raging between the teams, and their ranks have swelled as others join them. At the end of September 2015, Grätzel announced at a congress in Lausanne that his team had achieved a performance of 20.8%. This compares with the 25.6% of silicon cells which have been under development for more than 50 years. "Competition is stiff and there is a lot at stake", says Joël Teuscher, a researcher in the Photochemical Dynamics Group at EPFL. "But it is also healthy".

Today, the performance race seems to be on the home straight. Specialists are now asking more fundamental questions. "We are still looking to understand how this works exactly", says Teuscher. "This is a very passionate period in which work is becoming interdisciplinary". These questions will also help researchers resolve inherent problems of these materials such as their instability (they are fragile and soluble) and also the presence of lead in the crystals, something which may hamper future commercial applications. Although,

Hydrogen, fuel cells and memristors

Here are five researchers studying perovskites in Switzerland:

Aldo Steinfeld (PSI) is working on 'solar reactors' to transform CO₂ into hydrogen.

Fabbri Emiliana (PSI) is working on perovskite catalysers in fuel cells.

Jennifer Rupp (ETH Zurich) is working on perovskite-based memristors: a potentially faster and more energy-efficient resistive computer memory.

Christian Bernhard (University of Fribourg) is studying the magnetic and electric properties of metallic oxides, particularly at the interface of two materials.

Michael Lee (PSI) is developing analysis and processing techniques for ultra-thin hybrid-perovskite films.



These sediment structures from the drill core have just been cut open, and provide proof of earthquakes that took place tens of thousands of years ago. Photo: Daniel Ariztegui

Survivors of the Dead Sea

Microbial extremophiles have been found in the highly salty sediment of the Dead Sea. This discovery bears witness to the climatic conditions prevalent there for tens of thousands of years. *By Anton Vos*

magine being buried alive for 80,000 years beneath 200 metres of very salty sediment. Well, drilling expeditions in Dead Sea deposits have shown that microbes, pretty hard-headed ones at that, can remain very much alive in such conditions. Furthermore, they may shine light on the climatic conditions present when they fell to the bottom of the sea. This research was carried out by the doctoral student Camille Thomas and led by Daniel Ariztegui, a professor at the Earth Sciences Department of the University of Geneva.

"Studying the underground biosphere – the bacteria and archaea [Ed: bacteria-like unicellular organisms without nuclei] living below the earth's surface – started in the 1990s when we discovered microorganisms living 1.5 km below the seabed", explains Ariztegui. "It was then that we realised the microbes stuck in the sediment represented a huge biomass, possibly as large as all the vegetation on the surface. They play a potentially very important role in the climate and the carbon cycle. We therefore need to improve our understanding of how they are spread throughout the Earth's crust".

400 metres below the sea

The Dead Sea project was set up under a consortium called the International Continental Scientific Drilling Programme (ICDP). Drilling in the sea – actually a saltwater lake which sits between Jordan, Israel and Palestine – took place in the winter of 2010–11 and resulted in the extraction of a 450-metre core containing 230,000 years' worth of deposits.

"We used genetic sequencing to detect microbial presence", explains Ariztegui. "It's above all archaea that live in such conditions of extreme salinity, high pressure and high temperatures. The ones we discovered live in slow motion". A detailed analysis of the samples extracted from the core has convinced Ariztegui that these extremophilic microbes did not migrate into the sediment after it had settled. He thinks that they were trapped there when it formed – and therefore that they are representative of the chemical and physical conditions prevalent in the lake as far back as 80,000 years ago.

"These microorganisms live in slow motion"

Daniel Ariztegui

In addition, the fact that they are still alive tens of thousands of years later and that they have changed their environment may have a significant impact on the geological archives of lake beds. "These are very important results", says Gilbert Camoin, Director of the European Consortium for Ocean Research Drilling, the oceanic arm of the ICDP.

A seismic archive

The core of sediment has also allowed for new findings in the field of geological history. Researchers have been able to identify and date samples left by earthquakes that affected the region over the Dead Sea Transform fault system that separates the Arabian and African tectonic plates. Scientists have also been able to establish a stratigraphy of earthquakes and estimate their frequency.

Another spectacular finding of this 450-metre drill was wide variations in the level of the lake, particularly between the cold and wet, glacial periods and hot and dry, interglacial periods. According to these researchers, the Dead Sea was completely dry some 120,000 years ago, but this argument is still very much debated.

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

The English botanist and photographer Anna Atkins produced this cyanotype in circa 1854. She placed a dried fern on a paper impregnated with iron salts that turned into Prussian blue when subjected to ultraviolet rays.

Image: Minneapolis Institute of Arts, © Wikime dia Commons

Environment and technology

Prussian blue and X-rays

To understand how paint pigment deteriorates, researchers must focus on its infinitely small characteristics. *By Philippe Morel*

russian blue can be found on Hokusai's famous print The Wave as well as in the paintings of van Gogh and Picasso. The colour was discovered at the beginning of the 18th century and rapidly became commonplace in artists' workshops. Until that point blue had been difficult to produce, with painters habitually using ultramarine, a pigment of great expense created from lapis lazuli, or smalt, a fine powder made from cobalt which quickly lost its colour.

It was actually a chance contamination that led the paint manufacturer Johann Jacob Diesbach of Berlin to discover Prussian blue. It also turned out to be a very delicate paint. Although some artists did find it highly stable, others noted that it lost its colour very quickly when exposed to light.

A reversible degradation

Understanding why Prussian blue degrades became the focus of the work of Claire Gervais, a professor at the Bern University of the Arts. "These heritage materials are intriguing and lead to surprising knowledge", she explains. "They are heterogeneous and composite, and the mixture of organic and inorganic materials gives rise to sometimes unexpected properties. We still don't know how to recreate the production methods, which are often complex and the result of long development processes. In fact, these materials have a long history of ageing that we cannot find anywhere else".

The chemist in Gervais sees Prussian blue as a ferric ferrocyanide, more precisely $Fe_7(CN)_{18}$ ·xH₂O. It's the transfer of electrons between the two ions Fe^{II} and Fe^{III} that, by absorbing the red, gives rise to the bluecoloured pigment. But prolonged exposure to light subjects the pigment to the transformative process of photoreduction: the Fe^{III} atoms gain an electron to become Fe^{II}. When the Fe^{III} ions have all transformed, the transfer is no longer possible and the pigment loses its colour. This phenomenon is, however, partially reversible by exposing Prussian blue to oxygen in dark conditions.

Radiography of blue

To better understand what's happening, it's necessary to delve underneath the surface,

in other words to take X-rays. "X-ray absorption spectroscopy allows us to see the atomic signature of iron atoms in the pigment, as well as their state of oxidation and the direct environment within the structure", explains Gervais, who specialises in crystallography. "This way we can monitor both the changes in iron atoms during photoreduction and the subsequent loss of colour".

In the outskirts of Paris, the team uses a synchrotron – a ring-shaped particle accelerator which fires electrons along a curved path. The equipment can emit a powerful, stable and highly-focused electromagnetic array at a range of frequencies between infrared and X-ray.

"Heritage materials generate surprising knowledge"

Claire Gervais

Prussian blue is sensitive to visible light, and also to higher frequencies. "We knew we'd have difficulty analysing it without damaging it", says Gervais. "But the precautions taken were not enough: the pigment lost its colour in the beam". Yet upon analysing the damage caused by the irradiation, the researchers realised it was also the result of photoreduction. Useful indeed: Xrays were therefore not only of help in the analysis, but also in the methodology.

The Franco-Swiss team was naturally not working on samples from works of art, but rather systematically examining the influence of different artistic materials (paper, canvas, sizing, etc.) and the environment. They made sure to integrate variations of preservation strategies such as humidification, anoxia (reducing levels of ambient oxygen) and even applying acid to the paper.

Paper or pigment

The findings of these X-ray experiments cannot be directly translated to visible light, but they do demonstrate that Prussian blue degrades not only as a result of environmental factors but above all because of the material to which it is applied. Anoxia, humidity and potassium ions in surface fibres all cause the degradation of Prussian blue to accelerate rapidly, whereas acids slow it down. This conclusion is somewhat of a headache for museum curators, as anoxia is used to slow the degradation of paper, but it now appears that it accelerates the degradation of Prussian blue at the same time.

At any rate, the laboratory and the museum remain very distinct environments. Gervais's work has not yielded any miracle recipes for conserving or restoring works of art. What it can do, however, is to help identify works in need of specific conservation strategies because of the materials used or the conditions to which they have been exposed. For Verena Villiger, the Director of the Museum of Art and History of Fribourg, there is great interest in this kind of research. "Even without working directly within fundamental research projects, we can keep up to speed with developments through conferences and publications, although it's not always as close as we'd like to be. It's essential for scientists working in applied research to convert their new understanding of materials into preservation tools that we can then apply to our work".

Philippe Morel is a science journalist who works for the magazine Tracés.

Blue for biology

Prussian blue is not the preserve of great painters. Researchers use it as a biosensor to study redox processes in living tissue. Light also modifies the magnetic properties of certain related materials, opening up interesting research paths in the field of preserving digital information in the form of magnetic bytes.



This reactor changes urine into the solid, safe fertiliser struvite.

Problematic residues in urine

The provided set of the processed set of the processed set of the processed set of the problems in developing countries (see Horizons 106, p. 49). If urine could also be used to produce fertiliser, then we could kill two birds with one stone.

But here we must be careful: urine could quite possibly contain pathogens and drug residues. Researchers from EPFL and the water research institute Eawag have been investigating just what these might be. Their study has raised doubts as to whether we could use urine in this way without doing harm to human health and the environment.

Tamar Kohn's team at EPFL examined urine samples from dry toilets in South Africa from 2010 to 2013. The pathogens they found included rotaviruses that cause diarrhoea, and adenoviruses that cause inflammations of the eye. A risk analysis is now intended to clarify whether these pathogens could be a health risk to producers of fertiliser and to those who collect the urine. Furthermore, the researchers discovered several pathogenic bacteria. The drug residues included two antibiotics used for HIV prophylaxis, and a drug used to help prevent the spread of HIV infection.

Technology does exist that might be used to eliminate these residues. By adding magnesium compounds you can precipitate the mineral struvite, which is harmless when used as a fertiliser. Another option for making fertiliser is 'nitrification' followed by distillation. Filtering through activated carbon can then purify the rest. But this technology still has to be optimised. Only then can dry toilets be used to their full advantage in the production of fertiliser. *Sven Titz*

Breathalyser diagnosis

ost car drivers know about the alcohol tests that the police carry out using a breathalyser. You blow once into a little tube, and the meter tells you how much alcohol you've drunk. The medical world now wants to make use of the principle behind it. "Our breath is a window into our bodies", says Renato Zenobi of ETH Zurich. He and his colleague Malcolm Kohler from the Zurich University Hospital can diagnose illnesses using just exhaled breath.

This is possible because our breath contains numerous volatile substances that are connected to the body's metabolism. They are constituted differently from one person to another, but also from one illness to another. For their research, Zenobi and Kohler get groups of healthy and sick test subjects to blow into a mass spectrometer. The machine then analyses the breath of both groups in real time.

This breath test is already being used at the University Hospital to carry out reliable tests to diagnose chronic obstructive pulmonary disease and sleep apnoea syndrome. "The advantages are that it's absolutely non-invasive and the patients get their diagnosis within seconds instead of having to wait several days for blood test results", says Zenobi. At present, he and Kohler are also trying to use this method to diagnose lung cancer and pulmonary fibrosis.

Gert Printzen sees great potential in this new technology. He's a member of the Central Committee of the Swiss Medical Association (FMH), the umbrella organisation for doctors in Switzerland. However, he does point out the following problem: "At present, mass spectrometers are too big, and at half a million francs each, they're too expensive for use in doctors' surgeries". Atlant Bieri

P. Martinez-Lozano Sinues et al.: Breath Analysis in Real Time by Mass Spectrometry in Chronic Obstructive Pulmonary Disease. Respiration, 2014.



The breath test with the mass spectrometer enables lung diseases to be recognised.



On this scan of a mouse, the isotope scandium-44 shows up tumours (Tu).

Diagnosis accelerator

The particle accelerator at the Paul Scherrer Institute (PSI) has produced scandium-44. This isotope can be used in positron emission tomography to screen for cancer and has the advantage of a longer half-life than the mere hour of gallium-68. A longer half-life gives the body enough time to eliminate the isotope from the blood, as it otherwise hampers imaging and prevents doctors from excluding the presence of small areas of cancerous tissue. Another advantage, compared to short-lived isotopes, is that it can better survive the bench-to-bedside journey.

Scandium, on the other hand, "takes on average 12 hours to disintegrate completely", explains the study's co-author Roger Schibli of the PSI. "The body can therefore completely eliminate it from the blood, allowing a clearer image in which the tumorous cells that we are targeting can be distinguished easily. It even means we can detect secondary metastases that normally would be imperceptible". The researchers managed to produce scandium using the PSI's cyclotron, an electron accelerator, and have verified its quality and the ability to produce it quickly.

Working alongside the Laue-Langevin Institute in Grenoble, the PSI team has also produced another, even more radioactive scandium isotope. "Scandium-47 can be used in radiotherapy, whereby a patient ingests small doses of the radioactive material, which then accumulate within the tumour and destroy it", says Schibli. So scandium can actually be used for both diagnosis and treatment. And as the chemical properties of the two isotopes are identical, there's no need to conduct separate safety tests. *Daniel Saraga*

N. P. van der Meulen et al.: Cyclotron production of ⁴⁴Sc: From bench to bedside. Nuclear Medicine and Biology (2015).

H. Bischel et al.: Pathogens and pharmaceuticals in source-separated urine in eThekwini, South Africa. Water Research, 2015.

More real than virtual?

In 2016, we will see the arrival of improved virtual reality (VR) headsets. A Genevabased start-up is increasing the sense of immersion by making it possible to interact with real objects. By Daniel Saraga Illustrations by ikonaut

1. 3D headset

Oculus Rift glasses create a three-dimensional experience by displaying slightly different viewpoints to each eye. The unit also tracks head movements using accelerometers – similar those found in smartphones.

2. Sensory combinations The new headset from Artanim is also able to track other parts of the user's body, introducing the possibility of interacting with physical objects and considerably increasing the feeling of immersion.

4. Unifying two visions

All of the information coming from the headset and the cameras is processed by a laptop in the user's backpack. Interestingly, headset data has very low latency, negatively impacting precision; whereas camera data is very precise, but not so responsive.

5. First applications

There are a number of potential VR applications, such as health (e.g., physiotherapy, treating phobias, training surgeons), culture (e.g., virtual museum visits) and architecture, although it's most likely that the first applications will be video-gaming and entertainment (e.g., haunted houses, rollercoasters and "augmented" shooting games). "We've entered into talks with amusement parks in Asia and the Middle East", says Caecilia Charbonnier, co-founder of Artanim, the company set up in Geneva in early 2015.

3. Capturing movement

The system comprises a dozen infra-red (IR) cameras, which track reflectors attached to the user's hands, feet and head by sending and receiving IR light. It then triangulates the position of each reflector, superimposing it into a virtual 3D environment. The user's avatar can then move within the virtual world alongside the avatars of other users. By simply adding extra IR reflectors to real-world objects (such as a torch), they too can become part of the simulation.

Knowledge under attack

By Thierry Courvoisier

In recent months, the political debate has broadened to encompass hostile positions against the humanities, and more generally against university knowledge. We are now hearing an argument based on the assumption that holders of social science degrees can only contribute feebly to the country's economic development. As



the press has quite rightly pointed out, however, the relevant statistics do not show any particular difficulty suffered by such recent graduates.

These attacks leave a bitter taste. By targeting knowledge in a specific domain - in particular the human and social sciences - they easily portray the impression that

knowledge is disruptive and that we're better off ignoring these topics than we are mastering them. But there lies a danger within any society that prohibits or cloisters knowledge: that it falls into the hands of people who decide what can and can't be studied. History speaks volumes of how abysmal our judgement can be when it comes to predicting the relevance of a discovery to future developments. Nobody in the 1930s, for example, thought that the theory of general relativity would do any more than tidy up the incoherent world of physics, yet it went on to underpin the geolocation system that we call GPS.

What's all the more surprising is that the authors of these attacks are often the same who argue that every person is their own free arbiter and that the 'market' decides better than any regulatory mechanism. Despite not sharing this opinion, I would have at least thought that those who move in free-market circles would also encourage the free choice of what to learn and study.

If we are to solve society's current problems - energy, public health, biodiversity and climate change, to name but a few emerging challenges - knowledge will have to come from all domains, including the human and social sciences. Of course, the solutions will be based on principles emanating from physics, chemistry, geology, biology, medicine and engineering, but at the same time there will equally be the need to radically transform the way in which our societies work. These transformations will only be harmonious if they are conducted on the basis of an in-depth knowledge of the psychological reactions of the inhabitants of our planet, as well as of economic mechanisms and social phenomena. Should we want to progress towards solutions that allow for the untroubled survival of our civilisations - if such a goal can be achieved at all - then we must ensure that the debate encompasses more contributions from the human and social sciences.

Thierry Courvoisier is a professor in astrophysics at the University of Geneva and the outgoing President of the Swiss Academies.

16 February 2016

The impact of synthetic biology

Young scientists in discussion at Bio.Fiction@Lausanne Amphipôle, University of Lausanne

Until 28 February 2016

Natural resources for life

Earth's Treasures: an exhibition about how we use natural resources Focus Terra, ETH Zurich

12-17 March 2016

To whom does nature belong?

The theatre production Naturzwei takes a look at the issue Kaserne, Basel

14-18 March 2016

Understanding the mind better

Activities during Brain Awareness Week Several Swiss cities

Until 20 March 2016

Images of the body from Vesalius to virtual reality

500 years of anatomical history Kulturama, Zurich

Until 10 July 2016

Salt - from the mines to your plate

Exhibition about an unusual mineral Museum of Natural History, Fribourg

Letters to the Editor

Answering the relevant questions

It was with great interest that we read the article on the SNSF's special programme 'Investigator Initiated Clinical Trials (IICT)' (Horizons, September 2015, p. 30). As an SNSF-supported organisation that is dedicated to patient-oriented clinical research, we find this initiative to be very attractive and forward-looking ... With IICT, a programme has been initiated that secures the complete financing of such projects. At the same time, another programme has been set up, entitled 'Protected Research Time for Clinicians'. This overall package could in future make it possible to answer relevant scientific and societal questions, and to support young scientists to the benefit of patient-oriented academic research and the medicine of tomorrow.

Swiss Clinical Trial Organisation, Prof. Gregor Zünd, President, and Annette Magnin, Managing Director

Values to be handed down

I completely agree with the gist of your recent article 'Yearning for slow science' (Horizons 106, September 2015, page 21). An end has to be brought to both publishing at all costs and publishing results of little or no interest. Neither is allowing science to progress. When all's said and done, publication serves to announce discoveries and not to promote individual careers. Creating a scientific article of quality requires time, rigour and sacrifice. These are the values that we should be instilling in our students.

Jean-Christophe Leroux, Institute of Pharmaceutical Sciences, ETH Zurich

Director of SNSF moves to CURAVIVA



After ten years as Director of the Administrative Offices. Daniel Höchli has decided to leave the Swiss National Science Foundation.As of April 2016, he will be the new Director of CURAVIVA. the

national umbrella association representing the interests of over 2,500 Swiss homes and institutions in the area of social and health care.

New President for the Academies



Maurice Campagna is the new President of the Swiss Academies of Arts and Sciences. He has been elected for four years and will succeed Thierry Courvoisier on 1 January 2016. Since 2003, Campagna has

been the managing director of Enterprise Consulting (technology and mediation) in Ennetbaden and Lugano. For many years he was a member of the Swiss Science and Technology Council and has been a Member of Economiesuisse's Commission for Science and Research since 1989. From 2017, Thierry Courvoisier will chair the European Academies Science Advisory Council.

Ten new Research **Councillors elected**

At the general election of the National Research Council for the 2016-19 period, 85 Research Councillors were confirmed in office. Ten new Councillors were also elected, namely: Humanities and Social Sciences division: Roberto Caldara (Fribourg, psychology), Jürg Rössel (Zurich, social research) and Peter Auer (Fribourg, linguistics); Mathematics, Natural and Engineering Sciences division: Rémi Abgrall (Zurich, applied mathematics) and Paul Dyson (EPFL, chemistry); Biology and Medicine division: Mathias Peter (ETH Zurich, biochemistry), Cem Gabay (Geneva, immunology), Adrian Ochsenbein (Bern, clinician) and Dominique de Quervain (Basel, psychiatry); and in the Programmes division: Anna Fontcuberta i Morral (EPFL, material sciences).

Ambizione: grants for 67 young researchers

The SNSF has awarded 67 grants to young researchers following this year's call for its Ambizione funding scheme. A total of 360 researchers applied. Ambizione is a funding initiative of the SNSF that enables young researchers in all disciplines to start conducting independent research.

A guide for research with human subjects

The Swiss Academy of Medical Sciences (SAMS) has updated its manual on "Research with human subjects". It provides practical advice for the design, conduct and ethical assessment of studies of this nature. The new version takes into account the legal changes that came into force on 1 January 2014. ► www.samw.ch/ en/Publications/Compendia.html

SNSF Research Councillor Laurent Keller receives Marcel Benoist Prize



The Marcel Benoist Prize for 2015 has been awarded to Laurent Keller. Professor of **Evolutionary Biol**ogy and Director of the Department of Ecology and Evolution at the

University of Lausanne. He has already been given several international awards for his research into ants. In the year 2000. he received the National Latsis Prize and in 2010 secured an Advanced Grant of the European Research Council. In line with its statutes, the Benoist Prize has been awarded every year since 1920 in honour of "the most useful scientific discovery or study, in particular in disciplines which are of significance for human life".

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The SNSF

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

The Swiss Academies

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

"Like Brad Pitt with spectacles" Corinna Virchow page 24

"I don't know if I'd have been able to stick it out" Hans-Christian Baumann page 35

Male (M)
Female (F)
Intersex/Indeterminate/Unspecified (X)

Since 2011, when you apply for a passport in Australia you can choose between three genders.

"These microorganisms live in slow motion" Daniel Ariztegui page 45