SUGAR, SUGAR EVERYWHERE... 

THE CHALLENGE OF DIGITAL SOVEREIGNTY 

A PARTNERSHIP WITH A HEART 

Gone with time
Roland’s Breach seen from Millaris plateau (Ordesa valley, Spanish Pyrenees).

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Editorial

It is just over two years now since our university was established. Two years during which everyone’s efforts have helped to establish one of the leading French academic institutions, in a constantly changing national landscape. The excellent evaluation of our research labs, the ongoing certification of our new training opportunities, the recognition of our governance and its administrative control as well as a healthy budgetary situation are all assets which make us strong. A recent study conducted by IPSOS also shows that the international reputation of the University of Bordeaux is growing quickly. This is a result of the quality of its training and research, its attractiveness and its vision of the future.

The future – it is true that it is something of an obsession for us. We need to anticipate it and we’d also like to shape it. We’re not being overly ambitious, just realistic, since our current students are the people who will help to build the future. To better write the future chapters of its story, our university is currently developing a strategic 10-year plan known as U25, setting the main objectives that define what we will become: conducting creative research that has an impact on our society, renewing our academic approach and investing in intelligent and sustainable development.

The regular publication of U accompanies this university system and promotes the new image of higher education and research. Our magazine is gradually finding its place among readers who are no doubt discovering our potential for knowledge, talent and innovation. We’ve decided to talk about time in different ways in this fifth edition. Whether material or philosophical, it reminds us of this need to look to the future and the desire to move forward in search of progress.
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Stéphanie Debette, a brilliant mind
In a day and age when the color green is all the rage, and the fashionable buzzwords are “sustainable development”, “renewable energies”, “protection of biodiversity”, and “COP 21”, it’s no surprise that students want to make their voice heard on the subject. Such is the case of the naturalist association Astragale et la fourmi, (in English, Astragalus and the ant). Except that this University of Bordeaux association is not the product of recent trends, but in fact originated in the early 1960s.

What unites the members of Astragale et la fourmi? It is their civic commitment focused on raising awareness and mediation, creating new practices for improving the relationship between man and nature. “We want to take the bull by the horns and bring new initiatives to the university, things that do not currently exist,” insists Raphaël Kubath, the association’s president since September 2015, a Master’s student in Ecology and Functioning of Terrestrial Ecosystems, at the University of Bordeaux. In reality, the students focus very little on the rhetoric of COP 21, preferring instead to work towards offering real, practical solutions. Not just green then, there is also a militant hue running through this group. And this is nothing new. Historically, the association was purely naturalist, used to illustrate and support the classroom lectures at the university,” explains Eymeric Dugois, an active member of the association, in charge of the vegetable garden and a former vice president. This reality is confirmed by Mireille Verna, president of the association Cap Terre², a retired high school teacher and former student member of the Bordeaux naturalist club (Club naturaliste bordelaise), the initial name of Astragale et la fourmi. “We wanted to establish a group to get out and about, discover nature in the region, create inventories of the fauna and flora.” At the time there were roughly twenty people participating in the outings. “However, if you want to understand the basis for the association, you have to remember the day and age. It was an entirely different context, be-

"Astragale et la Fourmi": students committed to the environment

This student association, with its history spanning half a century on the Bordeaux campus, is on a mission to raise awareness and protect the environment.
Historically, the association was purely naturalist, used to illustrate and support the classroom lectures at the university.

“We wanted to establish a group to get out and about, discover nature in the region, create inventories of the fauna and flora.”

A Vegetable garden and zero waste

Throughout this period, the association was made up of only a few members, friends who were passionate about nature, mostly Master students in Ecology. Then Prehistory and Paleontology students joined the group in the mid-90s, which explains the name changing to l’Astragale, in English astragalus— for the name of a plant and a bone in the foot – et la fourmi (and the ant). Historically, a generation of students took ownership of the association. Then, over the years, they would finish their studies and make room for a new generation, without passing on their experience. Since 2015, the association wants to ensure its actions will continue. Thanks to a greater investment in communication, they were able to inform more students and recruit new members. "All that is happening this year in terms of organization will be able to be passed on over the long term. It’s really inspiring," explains Eymeric Dugois, active member in charge of the vegetable garden and former vice president of the association. "Another key strength is that it brings together different age groups among the members and even the leadership team," added the president.

The naturalist activities – the orientation weekend in Hostens, southern Gironde, in the Landes de Gascogne, ornithological outings in Le Teich or on the campus – are always welcomed by the roughly 60 members. In addition, the association is also committed to protecting the environment through various actions. The vegetable garden, for example, allows enthusiasts of all ages and horizons, students and non-students, to come plant their own vegetables and learn the art of ecological vegetable gardening on the Talence campus. "We offer various dynamic activities on gardening in partnership with the Pessac association Terre d’Adèles," explains Eymeric Dugois, who leads the actions in this area. Since 2011, the association has become involved, along with teacher-researchers, cultural leaders, managers of the university’s heritage and green spaces, among others, in the 3B project (Biodiversity, Biomass, Bordeaux) to protect and enhance the biodiversity and wealth of animal species and plant varieties on the campus. With the continuing goal of having a greener campus that is more respectful of the environment, the students organize "zero waste" operations. Conferences and other film-debates will round out the wide array of activities all throughout the year. These busy ants are on a mission! 

JD & DC

1 United nation Conference on climate change – Paris 2015
2 Aquitaine committee of planet Earth, association born during the International Year of planet Earth 2008

1 United nation Conference on climate change - Paris 2015
2 Aquitaine committee of planet Earth, association born during the International Year of planet Earth 2008
Looking back on the lives of a scientist couple from the University of Bordeaux who dedicated their lives to studying the origins of humanity, in Périgord and the world over.

A couple passionate about Prehistory: The Bordes

On the benches of the University of Bordeaux in the early 1940s, in the former university buildings, now home to the Musée d’Aquitaine, in nearby cafés... This is where literature student Denise de Sonneville met science student François Bordes. A pretty ordinary start to the rich and extraordinary lives these two scientists would go on to lead. The domains of History and Prehistory often only remember the second of these two names. François Bordes was appointed professor at the Faculty of Science, University of Bordeaux in 1956, where he became director of the Laboratory of Anthropology and Prehistory, a role he held until his death in 1981. He is also remembered as the former Director of Regional Prehistoric Antiquities from 1957 to 1975. François Bordes was the inventor of the method that bears his name: a statistical method for lithic industries (all of the stone objects intentionally transformed by humans: weapons made from flakes of chipped stone...) that he applied to the Mousterian period. Furthermore, in 2009, there was a symposium and a book dedicated to the prehistorian nearly thirty years after his death. Yet for Julia Roussot-Larroque, “this tribute would be incomplete and distorted if it failed to include the person who accompanied him for nearly forty years on a daily basis, both in his career and private life, Denise de Sonneville-Bordes. They are in fact inseparable; considering François Bordes by himself would be both an injustice and a mistake. Although they both dutifully chose their own respective specialized areas of research—his being the Lower and Middle Paleolithic period, and hers the Upper Paleolithic period and its extension to the end of the glacial period—in reality there were no true barriers separating them.”

A vocation inspired by The Quest for Fire

Their backgrounds set them apart before their studies united them. He was a child of the Périgord region, raised by a nanny in the country while his parents lived in the colonies in sub-Saharan Africa. At age seven he was already “carving flint arrowheads to hunt birds,” and at age 15, while digging by himself in the Lot-et-Garonne region, he met Raymond Vaufrey, a professor at the Paris Human Paleontology Institute, his future mentor and the thesis supervisor for both the Bordes. Denise de Sonneville was born into a noble family and an artists’ workshop. Her father, Georges de Sonneville, was the founder of the Independent Bordeaux artists’ movement (les Indépendants bordelais), and her mother, Yvonne Préveraud was a painter, illustrator and set designer for the Paris Opera. Her “studies of...
The Bordes were experiencing prehistory and inspiring others to follow... as well as provoking some controversies.

The lives of The Bordes at a glance

<table>
<thead>
<tr>
<th>Her:</th>
<th>Him:</th>
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<tbody>
<tr>
<td>29 décembre 1919 born in Bordeaux.</td>
<td>30 décembre 1919 born in Rives, Lot-et-Garonne, France</td>
</tr>
<tr>
<td>14 août 1943 wedding</td>
<td></td>
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<tr>
<td>1952 entered the CNRS</td>
<td>Novembre 1944 wounded during war operations in the Médoc pocket of German occupation</td>
</tr>
<tr>
<td>1958 PhD thesis directed by Professor Raymond Vaufrey</td>
<td>1951 PhD thesis under the supervision of Professor Raymond Vaufrey</td>
</tr>
<tr>
<td>1959 received the CNRS silver medal</td>
<td>1954 publication of Ceux de nulle part (his first novel)</td>
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<tr>
<td>1975 appointed research director of the CNRS, President of the French Prehistoric Society</td>
<td>1955 appointed university senior lecturer at the University of Bordeaux</td>
</tr>
<tr>
<td>21 mai 2008 passed away in Gradignan, Gironde</td>
<td>1979 establishment of the French Archeological Mission in Australia</td>
</tr>
<tr>
<td></td>
<td>30 avril 1981 passed away in Tucson, Arizona, buried in Carsac (Dordogne)</td>
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literature and history, and the artistic community she had become acquainted with through her parents, contrasted with her future husband’s training as a naturalist, geologist and prehistorian. She too was interested in ethnology and she pursued this interest through a mission to French West Africa beginning in 1946. Both had read The Quest for Fire, the 1909 novel by J.-H. Rosny, at a very young age, which inspired the vocation of many prehistorians, including François Bordes at 11 years old. This book also left an impact on the literature enthusiast, and her husband “does not seem to have had much trouble reorienting the course of her studies from those she had originally chosen.” They met at a time when their discipline was more of a passion and a pastime for doctors, teachers and members of the church, than a science studied at university. In fact, François Bordes himself said that he had never taken a Prehistory course, but had taught himself. They deeply respected the amateur enthusiasts. Up until 1981 for him, and 1991 for her, they worked to create more consistency, even as they raised their three children. He had a double professional life, as may be seen with the 7 novels and 19 science fiction novels he wrote under the pen name Francis Carsac, which met with some success. In this form of expression as well, he was “committed to scientific realism.” From the sites of archeological digs in Périgord and Spain, Africa, and Australia, to university classrooms in Bordeaux, North American universities, and international conferences, to the university for him and the CNRS for her, the Bordes were members of many academies and scholarly societies, and authors of numerous publications, experiencing prehistory and inspiring others to follow... as well as provoking some controversies. “Although François Bordes’ views on the variability of the Mousterian period can today be called into question, his contribution nevertheless represents a solid basis for new research,” explains Michel Le Noir. This prehistorian, an honorary CNRS researcher, whose thesis was directed by Denise de Sonneville-Bordes and to whom François Bordes taught the basics of carving flint arrowheads, had the opportunity of spending time with them over a period of many years. “They were a couple that adored each other and complemented one another. He had a quick and impulsive nature, that hid a certain degree of shyness, and she was more at ease socially.” These two vibrant individuals left their mark on the study of human origins, particularly within the Bordeaux School, after World War II.
A researcher full of curiosity, a philanthropist, and much more, Stéphanie Debette, Professor of Epidemiology and Hospital Practitioner in Neurology, recently arrived in Bordeaux where she is continuing her research with zeal and enthusiasm.

Stéphanie Debette, a brilliant mind

Her enthusiasm has not aged a bit. “I have been passionate about research since I was a child,” jokes Stéphanie Debette, 40 years on. “I chose medicine to understand the functioning of the brain, but I was interested in many other things, like languages, art and history.” Her boundless intellectual curiosity and her attraction to life abroad keep her moving forward. Rather than follow a direct path, the young woman has preferred to take a few detours. From Lille where she studied medicine, to New York, London, then Boston where she completed a two-year post-doc from Neurology, her residency specialization, to epidemiology and genetic epidemiology that she studied at the same time and teaches today. Then on to Paris, where she returned to the French university hospital system and met Professor Christophe Tzourio, leader of an epidemiological survey on the health of students - the famous i-Share cohort - selected to be part of the French Investments for the Future program. He joined the University of Bordeaux in 2012 and is responsible for Stéphanie Debette coming aboard the Bordeaux ship two years later.

The American dream

During an internship for her medical studies in a hospital in the Bronx in New York, Stéphanie Debette promised herself that she would return to the United States someday. “I was fascinated by the American dynamism,” she confesses. “And at that time I really wanted to do my post-doc there.” A few years later, in 2007, during a neurology conference in Boston, she met a statistician from the Framingham study. Well known by insiders in the field, this long-term epidemiological study that started in 1948 in the city it is named after (Massachusetts-USA) aims at detecting the risk factors of cardiovascular diseases. The subject was perfectly adapted to the research conducted by Stéphanie Debette, which she had started in Lille, on the causes of stroke in young adults, which led to her conducting a comprehensive study from start to finish. “I was very excited because the revolution of high-speed technology, applied to genetic studies, was in full swing. New methods were being tested at an international scale to carry out these studies and Boston was one of the first universities to use them. I was lucky; my application was accepted right away.” The following two years were particularly
rewarding, both on a professional and personal level. “I learned a great deal alongside the researchers. They work collaboratively in a network with many laboratories throughout the world. An American way of doing things that was very instructive!” the young woman enthuses.

**A researcher, always and forever**

Back in Paris in 2010, after having twin daughters, the young mother returned to the university, that of Versailles St Quentin, then Lariboisière, and INSERM. The recipient of a Chair of Excellence from the French National Research Agency, since her return she has been working in direct collaboration with the epidemiology unit directed by Christophe Tzourio. An experience enriched by those of the past. “Each stage brings with it a unique experience and contacts, it is truly invaluable,” she confides. In 2014, she obtained the position of Associate Professor of Epidemiology and Hospital Practitioner of Neurology in Bordeaux, as well as a “young researcher” grant from the select European Research Council (ERC) for her SEGWAY project. This project aims at studying the specific genetic markers in the structuring of the brain in young adults, using magnetic resonance imaging as part of the i-Share study. For this significant program she will benefit from a grant of €1.5 million over 5 years. In addition to this, Stéphanie Debette is simultaneously leading other projects the world over. Always involving fruitful interactions, meetings and opportunities.

Although she devotes the majority of her time to research, the doctor in her still values the importance of the clinical aspect of her career. “It is important to maintain this human aspect,” she insists. “Contact with patients is the initial motivation that led me to study medicine and provoked the ideas that now inspire the research we are carrying out.” She has come full circle.

**Music for the Brain**

This “crazy idea” of using art to serve science is indeed one that is full of life. A pianist and music lover in her free time, Stéphanie Debette has also succeeded in the challenge of creating the Music for the Brain association, aimed at organizing musical charity events for supporting brain research; an initiative generously supported by the Bernard Magrez Cultural Institute, with support from the University of Bordeaux and the Fondation Bordeaux Université. Two benefit concerts have already been held and were very successful with the people of Bordeaux.

The new resident of the city particularly appreciated this. “I was strongly encouraged and supported by the Bordeaux Initiative of Excellence and the University of Bordeaux. Within the establishment, researchers collaborate closely together, dialogue and discussion are favored. Last but not least, Stéphanie Debette states that she is very happy living in Bordeaux, discovering a region previously unknown to her. A balanced and fulfilling quality of life for this impressive forty-year-old who wears many different hats.

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1 Professor of Public Health, Hospital Practitioner, UMR INSERM Director / University of Bordeaux, Research Center Bordeaux Population Health, and primary investigator for the i-Share cohort

2 www.i-share.fr

3 Study on Environmental and Genome Wide predictors of early structural brain Alterations in Young students

“It is important to maintain this living clinical aspect. Contact with patients provokes the ideas that in turn inspire the research.”

www.i-share.fr
When time stands still, when time flies and when there’s not enough time. Changing times. Being in tune with time, ahead of time or behind the times. Wanting to stop the clock or travel back through time... Living for the moment. Wanting to control it, quantify it, chop it up... The past which is no more, the future which is not yet and the present which is slipping away from us... So many worries and issues that feed everyone’s conversations on a daily basis. But what is time? Is it absolute? Do we suffer it? Is it irreversible? Is it incompressible? Is it an ally? Is it an enemy? Scientists and researchers of all kinds, philosophers, writers and poets, historians, religious scholars, sociologists and psychologists, economists and many others have been wrestling with many such metaphysical concepts and baffling questions since the dawn of time and will continue to do so for eternity. There are as many approaches as there are definitions...
As the Latin philosopher and theologian St Augustine once said, "What then is time? If no one asks me, I know what it is. If I wish to explain it to him who asks, I do not know..." As he affirmed: "the word time tells us nothing about the thing it refers to".

Around sixteen centuries later, Etienne Klein, the French physicist and philosopher of science, a leading authority on time, described it as "this mysterious thing that constantly renews the present".

He evokes the very vivid picture of a ‘prison on wheels’ when he talks about time: we cannot escape the present moment. But this prison is on wheels as it moves forwards... Besides, we often say that time flies, or, at other times, that it is standing still. But time does not have a speed. It is indifferent to our unrest and actions. One hour is one hour, whether we are happy or unhappy, alone or not, locked up in an office or as free as the air over the ocean. This is not time moving, but rather what moves with the times. A long time for researchers working to improve the future, a distant time for astrophysicists looking deep into the past...

Intangible and invisible, the concept of time - from the Latin tempus: time, duration, period - is perfectly polysemous and evokes change, duration, speed, waiting and old age... The cycle of the seasons and the stages of life, which range from birth to death, evoke the passing of time, which is thus associated with a succession of things and events. Time is also a social reality on which we all depend. It serves as our framework. The issue of time management is now at the heart of every debate. As a source of well-being or unease, the passing of time absorbs us. Modernity, technology and progress all play havoc with our relationship with time. When combined with all the time, our lives are accelerating.

So is there an urgent need for us to slow down? Only time will tell. 

“‘No man ever steps in the same river twice, for it’s not the same river and he’s not the same man’.

Heraclite, philosopher

“It is the time you have wasted for your rose that makes your rose so important”.

Antoine de Saint-Exupéry, aviator and writer.
Growing old in 2050

The figures have been well-established for a long time. Population growth projections for Europe predict that the over-60 portion of the population will practically double between now and 2060. In France, the peak should be reached as early as 2035, according to INSEE estimates, when 30% of the population will be over 60 (compared to 23% in 2010). The cause: baby-boomers ageing. How, then, can societal changes, diseases and public policy choices be anticipated?

What diseases will we die from 30 years from now? How to combat neurodegenerative diseases and how can public polices be adapted? Teams at the Bordeaux Population Health Research Center try to provide some possible answers.

Aging, a reversible phenomenon

“Aging is a constantly changing notion” says Jean-François Dartigues, a Neurologist and Hospital Practitioner in Epidemiology, Health Economics, and Prevention. “The announcement of a decline in life expectancy by 0.3 years for men and 0.4 years for women was a real surprise. This clearly shows that aging is not an irreversible phenomenon. In 2050, we will not age or die as we do in 2016. That’s
monitor the progression of neurodegenerative diseases. “Alzheimer’s disease and related disorders develop over 10 to 15 years or even longer”, says the neurologist. “In order to detect early symptoms of dementia we had to follow patients from an early stage. That’s one of the distinctive characteristics of research on ageing. Our efforts are based on a long-term approach”.

Two distinct cohorts to monitor the progression of age-related diseases

Two cohorts were thus established: the first, PAQUID (Elderly People in Aquitaine), has followed 3,777 subjects from Gironde and Dordogne, aged 65 and over since 1988. The second, called the 3 Cities (3C) study concerns 9,294 individuals over the age of 65, from Bordeaux, Dijon, and Montpellier. For PAQUID, psychologists are sent to homes of the people followed by the study every three years to measure the evolution of their cognitive functions. “We are probably the only group in the world with such qualified researchers and that makes all the difference in the quality of the data we collect”. For the 3 City study, blood tests and MRI brain scans were conducted. It is a real gold mine for resear-
chers, who come from around the world to use the data. “At the time, we were storing a quantity of DNA without knowing that we’d have so many techniques available to obtain precious information”, adds the researcher. “The quality of our research today depends first of all on the quality of data collected nearly 20 years ago and its storage during all this time”.

Higher education, a bulwark against Alzheimer’s

Since the beginning, PAGUID has produced 250 publications and the 3C study has produced between 350 and 400, half of which were published by teams external to the research center. All this work has helped to better understand Alzheimer’s disease and gain knowledge about factors for reducing the risk of incidence. Namely: higher education, better cardiovascular disease prevention, a rich social life, sports activity and a healthy diet. “Today the majority of women die with dementia and alone”, explains the researcher. “Current generations of women pursue higher education, work and do more sport. Everything suggests that changes in lifestyle will have an impact on ageing”. BPH teams have already confirmed recent information showing that the incidence of Alzheimer’s disease has decreased by 25% in Bordeaux between 1990 and 2000, and among women in particular. Another study, published in March 2014 by Hélène Amieva, Director of the Ageing and Chronic Pyschoepidemiology team, has demonstrated that further education slows down the appearance of symptoms of Alzheimer’s disease. For people holding university degrees, an average of 15 to 16 years go by between the first signs of the disease and dementia, compared to an average of 7 years in those who have not been through higher education. According to the researcher, this phenomenon could be explained by a “cognitive reserve” and increased mobilization of networks of neurons, which can compensate for brain damage in people who have benefitted from rich intellectual stimulation throughout their lives. Imaging data from the 3C study, analyzed by Alexandra Fouber-Samier, has also shown that the level of education was associated with differences in volume of grey and white matter, between subjects with high and low levels of education.

Questioning Health Policies

The ageing population also leads to the question of exploding health costs. In 2012, 11.2% of GDP was consecrated to financing health care, compared to 5.4% in 1970. Today, over three quarters of this expenditure is financed by public bodies with health-care representing nearly 17% of all public spending, compared to 11% in 1970. According to studies, technological progress could explain between 25 and 75% of the increase in health expenditure over the last fifty years. Innovation does allow for a decrease in individual costs, but it also leads to an overall increase in spending: more individuals are diagnosed and given care. The European Commission rightly underscored that political choices will have significant consequences on health care expenditure. A team at the Bordeaux Population Health Research Center team, led by Hélène Amieva, has just reached the end of a long research effort on the effectiveness of drug-free therapies, using group workshops or one-to-one consultations to fight against Alzheimer’s. “The results are negative overall”, says Jean-François Dartigues. “We have...
demonstrated that group workshops for memory stimulation are not at all effective against the disease. Only individual care has shown a difference, with patients being able to stay in their homes six months longer. Now that we know these workshops have no impact, should the social security pay for them? That is precisely the purpose of our research: questioning policies.

Verbatim: “Alzheimer’s disease and related disorders develop over 10 to 15 years or even longer. In order to detect early symptoms of dementia, we had to follow patients from an early stage. Our efforts are based on a long-term approach.”

A team dedicated to biostatistics

Within the Bordeaux Population Health Research Center, the biostatistics team, under the leadership of Hélène Jacqmin-Gadda, has developed applied statistical methods for monitoring the cohort. ‘Deaths, missed appointments, withdrawals from the study, these are all factors that must be corrected in longitudinal studies,’ explains Hélène Jacqmin-Gadda, ‘and that’s not all, there are a great number of factors that need to be adjusted’. For example, the cognitive tests used in the cohorts, which are internationally standardized tests, have ceiling and floor effects. ‘In other words, certain tests are not sensitive enough to measure cognitive decline at high levels or at very low levels. We have developed statistical models with estimation algorithms to adjust the data’. The team has also worked on future projections for the number of people with dementia and has obtained results that significantly exceed the usual estimates. ‘With our models, we predict a 75% increase in people with dementia in 2030 compared to 2010, based on INSEE’s mortality projections. This increase is directly linked to the estimated decrease in mortality. These figures are probably pessimistic. If there really is a decline in incidence, the number of people with dementia will increase by a smaller margin’.
The Universe speaks in the future perfect tense

“In looking far, we are looking back.” This quote from famous astrophysicist, Hubert Reeves, reminds us that when we observe objects in the universe from the earth using a telescope or the naked eye, things are not as they appear. They are older. How can this be explained?

In this age of immediacy and of “I want it all, and I want it now”, there is a reality that will continue to remain a mystery. When we gaze into the sky and look towards the sun (not directly to avoid burning our eyes) or the moon, we never see them as they truly are at the time of observation. Why is that? This is because the distances between these objects and the earth are so great that light takes time to cross them: one second for the moon, eight minutes for the sun. So if someone turned off the sun (a phenomenon unlikely to occur in the coming years), we would only realize it eight minutes later. A situation just like an astronaut alone on Mars, as in Mark Watney (played by Matt Damon) in the film *The Martian*, who was obliged to have conversations with earth that were delayed by 30 minutes, because radio waves travel at the same speed as light.

Light, the time machine

The distance spans four light years for the star that is closest to our solar system, Proxima Centauri. Therefore, when we observe Proxima Centauri, we see it as it was four and a half years ago. In 1981, astrophysicist Hubert Reeves referred to this phenomenon in his book *Patience dans l’azur* (translated as *Atoms of Silence: an exploration of cosmic evolution*), in the context of light: “The news they bring us is not new at all! For us, this is rather an advantage. We have found a time machine! In looking ‘far’, we are looking ‘back’. We see the Orion nebula as it was at the end of the Roman Empire, and the Andromeda Galaxy as it was when the first humans appeared, two million years ago. On the other hand, the hypothetical inhabitants of Andromeda, equipped with powerful telescopes, could see the dawn of humanity on our planet [...]”.

Reasoning in present tense

This means that astrophysicists (on Earth and perhaps on Andromeda too) use their telescopes to study the universe in “a future perfect” tense, as explained by Franck Selsis, CNRS researcher with the Bordeaux Astrophysics Laboratory. “But we can reason as if it were immediate; it doesn’t affect our research. We know it, but we don’t have to take it into account.” Yet he thinks about it at times when he observes the transit of an extrasolar planet that was predicted down to the second. This transit takes place each time a planet passes in front of its star and causes a variation in its light, which will allow researchers to detect this planet. “We realize that in fact we are watching a phenomenon that happened three centuries ago.” Quite a dizzying thought! The same is true of quasars, very bright, but distant stars... and therefore very old, as Hubert Reeves also explains. “Some quasars are located twelve billion light years away. The light that reaches us has travelled for twelve billion years, which, in other words, is eighty percent of the age of the universe... At the end of this incredible journey, they allow us to see the world in its youth. [...]”

DC

1 American movie by Ridley Scott (released in 2015)
2 a CNRS and University of Bordeaux unit
Do you know about the grandfather paradox? Chances are you will never be faced with this situation. It requires a time machine, and they are not easy to get your hands on. But just imagine... You were able to find one and traveled back in time to meet your grandfather (before he had children) and, deliberately or accidentally, you killed him. Now, just think. If you killed your grandfather, how could he have had children, including one of your parents? How could you yourself have been born? And furthermore, how could you have traveled back in time? This is a temporal paradox explored by the science-fiction world in the theme of time travel, “invented” as early as 1895 by British novelist H. G. Wells with The Time Machine. “Time is an intangible element in our sensory world, which is imperceptible to man. Science and philosophy struggle to define it as a concept,” explains Natasha Vas-Deyres, Professor of Literature at Bordeaux Montaigne University. “Humankind seeks refuge in the imagination of literature and movies, in an attempt to master what cannot be tamed.” Science fiction and fantasy, the two major genres in the imaginary realm, therefore attempt to represent time. Fantasy literature is marked by repetition and cycles of time, often presented as being magical. The past is constantly breaking into the present, often in terrible ways; which explains the presence of the living dead, ghosts and vampires. “Time is seen as resurging when the dead come back,” explains the specialist of suspense.

Haunting the authors of science fiction

Dracula (Bram Stoker, 1897) of course comes to mind, the prototype of the gothic vampire, the immortal zombie that defies time and exists in a dark world of phantoms and curses... Fantasy cinema uses the metaphor of a visual or narrative labyrinth to represent time: a story that keeps repeating itself for an extended period of time, or time standing still. The characters only have limited power over this transformed time. Think of the grouchy and melancholy weather reporter, Phil Connors, who woke up every morning on the same day in Punx...
sutawney, Pennsylvania in *Groundhog Day* (Harold Ramis, 1993). So how does science fiction (or SF) deal with time? For French author Michel Jeury, “SF is above all a machine for exploring time, which haunts all of its authors.” In the quest for scientific realism, it is therefore confronted with three difficulties, explains Natacha Vas-Deyres, the same ones we see in the work of physicist and philosopher of science Étienne Klein. “The word time barely says anything about what it is supposed to express. Is it a natural or cultural object? We can measure it, but we cannot observe it. And finally, it is not perceivable as a raw phenomenon.”

**Transgress the fantasy of science**

To summarize this idea with an illustration, if you were shut up in a cave (hence without any day or night reference points), would you know how to measure the passing time? Experiments with cavers have shown that you would not. Thus science fiction plays its way through these three difficulties to explore and manipulate time. Unlike fantasy that is more focused on the past, science fiction is primarily interested in the future. Since science fiction and physics are so complementary, throughout the 20th century authors have found their inspiration in discoveries in this field. In literature, René Barjavel interpreted certain principles of quantum physics in 1944 in *Le voyageur imprudent* (translated as *Future Times Three*), seeking to determine whether or not destiny is predetermined, and whether it is possible to influence one’s own existence within the flow of time. This leads to the novel’s main character being confronted with an ancestor and creating his own paradox. Time travel can be physical; it can also be subjective. In *Le temps incertain* in 1973 (translated as *Chronology*), Michel Jeury’s “psychronauts” come in contact with the psyche of people from the past by means of a drug and exchange personalities on a mental level. SF cinema also plays with the idea of time, twisting and turning it. It can, for example, be reversed, as the example of *The Curious Case of Benjamin Button* (F. Scott Fitzgerald, 1921) or in novels by Philip K. Dick that deal with consciousness and disturbed memory... Time is distorted when the characters are confronted with their own time line. Like Marty McFly in the *Back to the Future* trilogy (by Robert Zemeckis and Bob Gale, 1985) who meets his double from 1985 in 1955, after taking a trip to 2015 and before going to 1885... Did you follow all that? “Science fiction makes it possible to live out the fantasies inspired by science,” concludes the professor. Now it’s up to you to experience them by diving into these works without any time restraints.

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1. Holder of the Agrégation teaching degree in Literature, Associate researcher with the multidisciplinary research laboratory of Imagination Studies applied to Literature (LAPRIL/CLARE) at Bordeaux Montaigne University.


“Seasons don’t exist anymore!” or “the climate is off balance and the weather forecast is wrong all the time”. There are so many clichés about these concepts that get mixed together and confused in the average person’s mind, and yet they are clearly defined by specialists. It is essential for us not to get lost in this lexical fog.

Weather versus Climate

A matter of time

Will there be snow at Christmas? A sunny or rainy weekend? And will there be good weather tomorrow? This is the regular topic of our conversations around the coffee machine. We talk about the weather non-stop, but do we really know what it is? “Meteorology is defined as the study of current weather conditions and conditions in a very close future, referred to as ‘sensible weather’: 2 or 3 days or a bit longer” explains Gabrielle Castella, a weather forecaster for Météo France at the Bordeaux-Merignac office in charge of southwestern France. “Forecasts are based on observation through the measurement of meteorological data about atmospheric conditions”. This data comes from a wide variety of tools: ground stations all over national territory and in foreign countries, balloon probes, satellites, rainfall radars, airliners, etc. “Forecasting consists in extrapolating these observations in the future, a few days ahead of the current observation, using meteorological forecast models” explains Olivier Cabanes, a Météo France Research Engineer and Climatologist.

“When we refer to climate, time spans are a little longer in the past and in the future. And it includes statistical studies on this same data”, he continues. “To define the climate of a geographic area using statistical methods, meteorologists take the average of 30 years of temperatures, rainfall, etc. ‘This is the equivalent of one human generation’.

Extreme events: the climate has its say

Beyond simply telling us what the weather will be like at seaside resorts or just over our heads, weather forecasting is most importantly about anticipating the risk of extreme events and informing populations. In this respect, the climate has its say. Whether it is a matter of wind, rain, floods, storms, snow, or black ice, the effects of a particular event will be felt differently depending on the impacted area’s climate. Forecasting the slightest centimeter of snow in Bordeaux, for example, where every incident of snow is problematic and can have negative consequences, leads to a high alert level. On the contrary in Creuse, Corrèze, or Haute-Vienne, as long as there is less than 5 cm of snow, the phenomenon is neither exceptional, nor alarming.” Each
area’s climatology comes into play in producing the severe weather warning map which gives advice for behavior that is adapted to the phenomenon”, explains Gabrielle Castella.

Up against a temporal wall

“In 10 years, a great deal of progress has been made in storm forecasting for example. Research in modeling and computing power are the two driving forces for these advances”, the forecaster goes on to say. Indeed, representing these phenomena at the right time and in the right place requires a fine mesh, less than 2 km, which requires significant computing power, linked to the increasing power of computers. “Nonetheless, there is a wall that we cannot get past in terms of deterministic forecasts. The limit is situated between 10 and 15 day-forecasts. Beyond that it is only possible to give patterns on a national level because of the chaotic nature of the atmosphere” , affirms Olivier Cabanes. It would require knowing all characteristics of the atmosphere so acutely that the models could never follow. “Predicting a storm 15 days in advance? I don’t believe that for a second”, he concludes. ■ JD
Omni-present as it may be in daily life and everyday language, the concept of time evades all attempts at consensus as to its definition: it is a source of never-ending disputes and intellectual challenges for scientists and philosophers alike. The question is all the more difficult in that it changes from one era to another and with successive developments in the history of the sciences, especially physics. In the English-speaking world, during the 20th century, an entire philosophical discipline was specialized in this question: the philosophy of time, structured around two main views.

On the one hand, there is a metaphysical approach to time based on the conceptual analysis method, following the article written by John McTaggart, The Unreality of Time (1908), highlighting the key distinction between the “A-series”, characterized by the difference between past, present and future, and the “B-series”, defined by temporal relations of succession and simultaneity between events. On the other hand is an approach to time inspired by physics (thermodynamics, theory of restricted and general relativity, quantum mechanics and now quantum gravity). What is surprising is that this physics-driven approach leads most authors of the philosophy of time to the same conclusion as McTaggart: that time is indeed unreal. Counterintuitive as this theory might be, it is inspired above all by the theory of restricted relativity (1905) in which the “A-series” is perceived as an illusion for lack of an objective present, because that present varies from one observer to another. As stated by Einstein in his famous letter of March 21st, 1955: “For we convinced physicists, the distinction between past, present, and future is only an illusion, however persistent”.

The philosophy that tried to show that its object does not exist

Paradoxically, the philosophy of time is a discipline which devotes a large part of its efforts to seeking to demonstrate that its object does not exist! Like modern physics, however, it is far from being unified and might even seem like something of a battlefield between opposing forces, facing off over the divide between the “B-theory”, in which only the “B-series” succession exists, and the “A-theory”, in which time implies both “A-series” and “B-series”. The originality of these theories is that they base their conceptions of time on different models of the universe. In block universe theory, which is sometimes referred to as eternalism and unites most “B-theory” partisans under its banner, the universe is given in a single block for all eternity, meaning that all past, present and future events are already in place in space-time and have the same reality. Physicist Thibault Damour thus compares the universe to a musical score that springs up all of
a sudden in the brain of the genius composer, and which is already written at the moment when we listen to it.

This vision of things dominates at present in the philosophy of time, but is dismissed by "A-theory" advocates who claim that time is a part of the world's ontological furniture and that it "really passes", in the words of John Norton who defected from block universe theory to the other side. This camp is itself divided between a number of theories. Presentism defends the idea that only the present exists, for example, while in the growing block universe theory, the future has no existence and only the present and past exist and are constantly growing. Another version, known as the moving spotlight theory, combines block universe theory and "A-series". Its somewhat strange name comes from the comparison from which it originated: the history of the universe is perceived as a block that is already formed, but that block is then lit up by the present as it moves from past to future, like the spotlight of a watchman doing his street rounds at night. The houses that have already been lit up are the past, those currently in the beam of light form the present, and those still in the dark represent the future. One final key theory that is worthy of note is that of the branching universe, another version of the "A-theory" that draws its inspiration from quantum mechanics. In this model, the universe is like a gigantic tree in which the trunk corresponds to the past, while the branches are the various possibilities for the future, only one of which is realized randomly at each moment!

**Time reborn**

The limits of the four versions of the "A-theory" lie in the fact that they all suppose the existence of an objective present separating past and future, when the theory of relativity has made any such present somewhat problematic. Certain eminent physicists, however, such as George Ellis or Lee Smolin (who recently published the evocatively-titled "Time Reborn"), have pointed out that contrary to restricted relativity, general relativity enables a form of objective present to be defined, thereby overcoming that objection. It could be added that in the theory of restricted relativity, the notions of succession (between events with a causal link) and duration (the "proper time" indicated by the clock that accompanies the observer in its movement) can have an objective, invariable meaning, although that meaning is local, and not general as was the case in pre-relativistic physics. It would therefore seem that modern physics has not sounded the death knell of the notion of time, although it is transforming it profoundly, thereby obliging us to further our work on the question.

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What we call "time", the incessant flow of events from future to past via the present, is only the dynamic, purely subjective experience of a reality that is in itself static.
In our ultra-connected world, the boundary between work time and free time is greatly diminishing. Time management has become an issue of survival, as without it potentially dangerous psychological consequences may follow.

Optimizing your time, knowing how to manage it, saving it, not wasting it, running after it... No matter who we are, we are chained to the clock, reduced to being subject to the stopwatch. Yet no matter what we do, time keeps going... As Alphonse de Lamartine so magnificently put it, “In vain I ask for a few moments more; time escapes me and flies. I tell this night: abide and dawn comes melting away the darkness...” Time in the 21st century passes just as fast as in the 19th century. Yet while the week was peacefully organized around work and rest in a traditional household only 50 years ago, today we are faced with a much greater complexity in our pace of life. Our lives are overloaded, our activities have multiplied, our hours have changed. Technological innovations have greatly contributed to this disruption, and all sorts of digital tools have caused an explosion of the notion of time. On the one hand, they assist us in carrying out many tasks simultaneously and remotely in record time, yet on the other hand, smartphones and tablets also contribute to blurring the lines between work and private life.

Today immediacy is widespread and speed is proof of performance

These accelerations and changes inherent to this day and age can end up exhausting those who just endure them passively. Good time management is now on the list of the skills required for anyone who wants to have a relatively balanced life. This is evident from the number of books and coaches specialized in time management. At the University of Bordeaux, Professor of Psychology Nicole Rasclé focused her research on occupational health and its risk factors. “The main risk factors that threaten people’s health are all linked in some way to time,” she explains. “The amount of work, that is, the number of hours worked, working time arrangements (night work for example) and the timing of the workload distribution all generate stress.” Without addressing the extreme Japanese Karōshi phenomenon, which refers to the sudden death of executives or office employees of a heart attack after overworking, the famous burnout (a work-related exhaustion syndrome), a true evil of the century,
affects an increasing number of French people. This is all the more apparent from the great success that the English term has known, now used in everyday language, with all that this implies in terms of overuse and inaccuracy...

**Working without boundaries and time limits: danger ahead**

What is behind all of this? The growing role that work plays in our lives, sometimes even following us to bed at night, due to screens that invade our daily life. “Today, we must acknowledge that the ‘work time/time off’ distinction is tending to diminish. For some people it is common to bring files home and send emails late into the evening and weekend. Thus problems overflow from one area of life into another, leading to the sharing of emotions and feelings that can be damaging to the psychological health of individuals and their families,” explains Nicole Rascle. This lack of boundaries caused by the commonplace use of new technologies creates strong pressure to provide immediate results. Replying to an email right away, sending a text during a meal, leads to a lack of control. The sense of urgency means that we no longer consider the impact of our words, leaving us open to errors and confusion that sometimes have serious repercussions and are detrimental to our mental health. And we should also bear in mind that the addictive potential of digital tools leads to a disconnect with passing time... A vicious circle that can be hard to break out of.

Typically, explains professor Rascle, “individuals suffering from burnout do not know how, or are no longer able to compartmentalize their lives. Their

**Burn-out**

The term burnout was used for the first time in 1974 by the American psychiatrist Herbert Freudenberger in an article, *Staff burnout*. He defined it as being an “internal burn”.

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entire cognitive space is invaded by thoughts related to their work, with no space left for the rest. Thus, we see people forget their child in a car... or have an accident.”

A time for everything?

Women, and mothers in particular, prove to be better “compartmentalizers” than men, and as a whole they are more concerned with distributing their time well. Some say that when they leave work in the evening, they start “a second day”, signaling the transition to their private life. This brings to light the question of work time and the different arrangements possible. Ideally, to be in good physical and mental health, it should be possible to choose how to arrange one’s work time based on one’s responsibilities and family obligations... Not as easy as it sounds. And what do we make of the 35-hour work week? For Nicole Rascle, the intended effect of reducing health risks is still missing. “On the contrary,” she explains, “this decrease in regulated work time has resulted in increased stress, because the workload has not decreased accordingly.” According to her, the ultimate perversion of this system is seen in the presenteeism phenomenon. “In French culture, leaving work on time can indicate that we are slacking off, resulting in a poor self-image. Some will even make a point of being present in order to prove to their supervisor that they are good workers. It’s a risk factor.”

As for the tempting telecommuting option, it benefits those who do not need social interaction. It is advantageous because it allows high autonomy in managing one’s time. Yet the question of autonomy is also complex. For example, the Toyota-style2 method of organizing work time, which calls for the autonomy of teams in defining their standard production times. This so-called time control results in the group’s increased control of the worker’s productivity, adding additional psychological pressure on individuals... Not exactly ideal either. “This type of organization requires monitoring,” adds Nicole Rascle. Because time management must be learned, sometimes at the expense of an unfortunate experience.

The moral of the story: slow and steady wins the race, everyone must find the right pace... Easier said than done. ■ SBS

1 Alphonse de Lamartine (1790-1869) - Le lac. Méditations poétiques-1820.
2 The Toyota method, called “le toyotisme” in French, refers to the work organization developed in the 1960s by the Japanese engineer Taiichi Ono and implemented by the Toyota corporation.
Taggered or broken up working days, ever-longer commutes, flexible working hours... individual and collective time have overlapped for some time now, jostling the once well-oiled machine that separated the work week from lazy weekends. Since the early 2000s, around 30 French local authorities have adopted a “time office”, a dedicated team in charge of finding solutions to transport congestion as well as reassessing opening times for administrative services, daycare centers, libraries, or swimming pools. This approach comes from Italy, where the government has demanded that a time office be opened in every city with over 30,000 inhabitants.

The right to time

Working at the weekend has now become commonplace. 26% of employees usually work on Saturdays and 13% on Sundays, according to a study published by the DARES (Directorate for Research, Study, and Statistics) in 2015. Only half of employees claim to have the same schedule every day. This desynchronization is also compounded by an increase in time spent in transportation. “The rise of the automobile was seen as a great liberation that enabled people to live further from city centers”, explain Claude Lacour and Nathalie Gaussier, professors and researchers in Economic Science at GREThA1. “But for 5 or 6 years now, we’ve been seeing longer commuting times and all the big cities are congested”. It is a real headache that exhausts commuters and forces them to think up ways to get around traffic jams. “In certain regions, it’s reached a point where commuters are no longer in control of their own time”, continues the researcher. “Fluidity and accessibility are no longer possible at certain times, which is a real challenge for time offices”. In Rennes, for example, the time team tackled the problem of subway congestion during rush hour, between 7.45 and 8.15 am. With the cooperation of the major “flow producers”, namely two high schools, the hospital, and two Rennes universities, class times at Rennes 2 University were shifted. The number of people using the subway during the worst half-hour period decreased by 5%, and by 15% on the trains to the university.

Real vs perceived time

“We have a relationship with time that operates according to psychological thresholds”, states Claude Lacour. “In a smaller town like Mont de Marsan, for example, if congestion lasts 10 minutes it seems unbearable. For a resident of Bordeaux, the tolerance threshold will be 54 minutes and for a Parisian it will be even longer. This underscores the importance of habits and learning, as well as difficulties in modifying behavior, even in a limited way. The issue of time has shifted from real time to perceived time. In addition, time management is no longer the responsibility of local authorities alone. All the different stakeholders are now considering the issue”.

JZ

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1 Theoretical and Applied Economic Research Group. CNRS/University of Bordeaux joint research unit
The incompressibility of time

On a daily basis, researchers must manage many different parameters, including that of time. How it should be anticipated, dealt with... Strategies differ depending on the field. The following are a few examples.

What do a space mission, the tracking of a disease and the restoration of an ecosystem have in common? These are just a few examples of scientific research with rather long, even slow time frames. Finding new ideas, setting up studies and experiments (coming up with the necessary funding) and obtaining results all require time. Yet researchers are also faced with the incompressibility of time. How can it be integrated so that progress may continue? Depending on their field, researchers turn to different strategies. Astrophysicists, working on space missions, are obliged to take a chance on progress in technology, for example. Why? Because at the time the researchers propose a telescope project to a space agency, in other words 15 to 25 years before its launch, the technology that will make the mission possible (the energy consumption or the power of a given instrument, a camera’s resolution, the performance of a certain type of fuel…) does not yet exist. This risk is not entirely reckless, however, explains astrophysicist Fabrice Herpin because “we base things on the way technology has been advancing, and generally speaking, this works. In the end, it is also a way of pushing for innovation.”

No short-term research impacts

However, this timeframe has other consequences. It forces researchers not to focus on only one project. “Before one project is finished, we set up others,” explains the astrophysicist. For researchers in ecology, short-term vision does not exist either. Didier Alard works in particular on restoring wetland areas around Bordeaux. The

The Herschel space telescope

The Herschel mission lasted a little over 35 years, from 1978 when, for the first time, researchers needed and thus came up with the idea of a telescope that could observe in infrared, through to the telescope being put into orbit in 2009 and on to today when the mission is coming to a close with the publication of scientific articles on the obtained results.
goal is to allow former corn fields to become wet meadows, rich in species, once again. It should take 30 years for all the plant and animal species to return. How can we tell whether the actions of the researchers and site managers, within a context of climate change, will lead to the intended restoration in the future? To determine this, it is necessary to track the changes in the area over time and compare them little by little with modeled data. The problem is that since this science of ecological restoration is still young, very little comparative temporal data exists. Yet, a network is beginning to take shape to stabilize this research over the long term, an international network of pilot sites that represent the different ecosystems that have been studied, explains the Professor of Ecology from the University of Bordeaux. In the meantime, scientists use another strategy; they try to find similar environments in order to establish comparison models. “For example, if we need to study the dynamics of a pine forest, we currently have examples of all stages in the Landes area, from the 2 year planting stage to the forest crop of a century.” Didier Alard acknowledges that time is a limiting factor, and that it is difficult to obtain results that will have an impact on short-term research. This is the case for the natural environment, but can also be the case in the laboratory. For Benjamin Dehay, Research Fellow with INSERM at the Neurodegenerative Diseases Institute, “this question of time is a little schizophrenic at times, because we need to go fast, but that’s not always possible.”

Working for a community over time

In his work on Parkinson’s disease, he studies cellular models in vitro in order to find therapies. However researchers also need to develop suitable animal models in order to test these therapies and study in vivo this disease, which affects the elderly population. So of course, there is no other choice but to wait for the animals to age and for the onset of the disease. An incompressible parameter. The same is true for the study of human populations, their diseases and their health. In fact, Christophe Tzourio sees time as the final frontier for epidemiology. He leads the i-Share cohort, which has the objective of monitoring the health of 30,000 students over 10 years. But the researcher would like it to last much longer. “We would like to be able to observe the appearance of certain diseases among young adults, find the determining factors very early on, such as those for Alzheimer’s disease for example.” To accomplish this, it would be necessary to monitor this population, who are 20 years old today, until they are 70. “An Everest” for the epidemiologist, who knows in the end that he will not be the one to reach the top. “We work for the benefit of a community over time. We will pass the torch on to following generations of researchers. However, we have a great responsibility. We must build the foundations for this study with rigor and vigilance, so that the data can be exploited later.” But, like all of these researchers, he knows it will work. Time is a constraint, not an obstacle.
CDs, DVDs, and other Blu-Ray disks have short life expectancy. In Bordeaux, teams have developed methods for archiving data on glass disks.

Information recorded on glass

Will we still be able to read burned CDs of our holiday photos 30 years from now? And our IRM DVDs? Our work computer’s backup disk? The answer is a resounding no. CDs, DVDs, hard disks, USB keys and memory cards are all digital media with very limited life spans. Between 4 and 15 years maximum,” says Lionel Canioni, Director of the LAPHIA1 cluster. In the beginning, manufacturers sold them as archiving solutions that were practically eternal. But studies have shown that CDs and DVDs are affected by humidity, heat, and light. A difference in life spans can be observed depending on brands, models, and even serial numbers”.

Burning on a nanometric scale

How can we ensure that our intangible heritage will be passed down to future generations, and that sensitive data, such as the locations of radioactive waste sites, will be recorded? Since 2004, the national network of laboratories specialized in data archiving, GIS-Spadon2, which includes Celia3 and the IMS4, has been discussing these questions. Their sights are set on using glass CDs. “We know that glass has a very long life span,” the physicist explains, “the difficulty lies in finding a way to burn the information so that it stays stable over time”.

Teams led by Lionel Canioni, Yannick Deshayes, and Thierry Cardinal, Director of Research at the Bordeaux Condensed Material Chemistry Institute5 explored the use of silver salts using the same principal as silver halide photography. “Using an electric field, silver ions are brought into a glass plate,” describes Thierry Cardinal. “At this stage they are colorless. Then, laser irradiation is used to modify the organization of the silver salts within the glass matrix. The silver salts that receive electrons go back to their metallic state and become fluorescent when excited by a light signal. This is how they encode information on a nanometric scale. To read it, we use a traditional Blu-ray player. Our glass CD absorbs blue and sends it back as another color, between green and red”.

Throughout generations

The Bordeaux teams have shown the effectiveness of their solution for preserving data for at least 100 years. But manufacturers are hesitant to move on to the standardization stage. “They think the market isn’t ready yet,” says Thierry Cardinal. “The problem revolving around archiving is relatively recent. We’re just starting to realize that we’re losing data and that we won’t be able to store everything in our servers”.

1 Lasers & Photonics in Aquitaine - Bordeaux Idex
2 Scientific interest group for lasting media for archiving digital data
3 Application and intense laser centre - CNRS and University of Bordeaux unit
4 Materials and Systems Integration Laboratory (CNRS unit, Bordeaux INP and University of Bordeaux)
5 ICMCB (CNRS unit, associated with University of Bordeaux)
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Sugar, sugar everywhere...

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Trust and honesty, the two pillars of research

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In Bordeaux, a Beaux-Arts style building that pays tribute to science, the city and the country

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The challenge of digital sovereignty

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Allergies: when the immune system goes haywire
Not only white, not only brown. 
Solid and liquid, granulated and 
powdered, cut, mixed, refined, 
derived... Sugar is hidden where 
we least expect it. Once it is 
swallowed, it is transformed into 
glucose and fructose. Although 
glucose is an essential source of 
energy required for the healthy 
functioning of cells, it also produces effects 
that resemble those of narcotics. This addictive 
phenomenon was discovered and is explained 
below by neurobiologist Serge Ahmed.

In Bordeaux, Serge Ahmed’s research team is 
investigating addiction patterns in animals. 
In order to do this, the scientists are 
carrying out original, innovative experiments 
on rats that self-administer heroin or cocaine 
intravenously. All the characteristics of the 
addiction are then observed by the researchers: 
the increase in consumption, difficulty to abstain, 
vulnerability to relapse, and the decrease in the 
reward threshold levels in the brain. Over the 
course of these experiments, the rats were given 
the choice between a sugary drink and increased 
doses of cocaine. As surprising as it may seem, 
out of the 100 rats tested, over 90 preferred 
the sweet taste to the feelings produced by the 
drug, even after reaching the maximum dose 
of cocaine, and even after several weeks of 
prolonged exposure to the same drug. As soon as 
they are given the choice, the animals turn to the 
sugary drink and prefer sugar intake to a highly 
addictive substance like cocaine.

This discovery, made in 2007 and confirmed 
since in several other laboratories, leads to 
the astonishing hypothesis that in rats, the 
addictive power of sugar is stronger than 
that of cocaine. According to this hypothesis, 
sugar is regarded as a drug. Is the same true for 
humans? Questions.

U: Could a line of gummy bears be stronger 
than that one of coke?

Serge Ahmed: It was with the goal of coming 
as close as possible to the reality of human 
consumers that we introduced the concept of 
choice in our experiments; we used sugar as an 
alternative to the drug because it is a reward 
that is easily accessible and easily controlled, 
and is common to humans and most mammals. 
The mechanism is the same for both species: as 
it enters the body, sugar, like cocaine, heroin or 
alcohol, activates the reward mechanism, the 
famous dopamine network. The first activation 
occurs through the tongue and the brain 
circuit for taste, then the sugar moves into the 
blood stream as glucose and reaches certain 
neurons in the hypothalamus that will activate 
the dopamine circuit a second time. This
second effect, which takes place 10 to 15 minutes after intake, is identical to that produced by drugs. Therefore, the consumption of sugar triggers the pleasure circuits in the brain twice.

But how do we get from this brain activity to a supposed state of sugar addiction?

SA: It is the accumulation of glucose from sugar in the brain that is problematic as sugar can be found everywhere. Added to all packaged foods, including those without a sweet taste, glucose is well hidden, yet very much present, and without our knowing it, the accumulation orients our brain towards an appetite for this type of food. Thus, in a very harmful manner, we are conditioned to consume too much sugar. In some individuals, this could lead to a state of dependence reminiscent of that which is produced by cocaine or heroin.

In addition, there is the psychological aspect, the image and the role of sugar, a sweet and comforting food, and a source of pleasure, that from birth has produced an immediate “reward effect.” Available anytime, anywhere, we consume it again and again... Addiction sets in when we can no longer manage this consumption, when it takes priority over other activities, and when the person in question ends up losing control over his or her desire...

However, in humans, only a minority of individuals exposed to drugs become dependent on them. We estimate, according to the type of drug consumed, that around 10% (for cannabis and alcohol) to 30% (for tobacco) of individuals will develop an addiction. The same is likely to be true in the case of addiction to sweet products, except that the frequency of those affected increases considerably with the body mass index and can reach 30% to 40% among obese people.

But what are the determining factors?

Why them and not me?

SA: If only we had the answer to that million-dollar question! Genes certainly play an important role, because they are the basis for our biological construction, including that of the circuits in the brain. But they do not act alone. The cultural and family environment that we are raised in, its history, beliefs, and also each individual’s unique traits are determining factors. Twins raised in two different families will certainly not have the same vulnerability in terms of addiction. On the other hand, unlike animals, we are all able to anticipate the future. We can consider the future negative consequences of chronic drug consumption. We can decide. Except that in the event of an addiction, we shut ourselves (like animals) in the present, in order to stifle our anxiety... And we comfort ourselves by eating even more sugar!

It is difficult to imagine that sugar could be a drug, especially since we consume it on a daily basis. However, awareness is beginning to grow about the dangers of this other “white powder” and research on the subject is continuing around the world.

“Any sweet product that is able to produce a high dose of glucose quickly in the blood stream has an addictive potential.”

Serge Ahmed, coauthor of the publication “Intense sweetness surpass cocaine reward” Plos One, August 2007

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Trust and honesty, the two pillars of research

Integrity is an absolute requirement for research. It is the essential value that enables society to trust the scientific community, and for researchers to be fully aware of their responsibilities and continue to be a driving force of progress. This question is central to the strategy of the University of Bordeaux.

As they work to produce new knowledge, researchers in every discipline build on the results obtained by other members of their community. They have access to these results through scientific publications. This process of advancement, founded on the work of others, requires that each step be solid. If one of the steps contains errors due to falsified or rigged results, it inevitably leads to an unacceptable waste of time and resources. The entire process is therefore dependent on scientists being able to trust previously published results. Breaches of scientific integrity, which exist in every discipline, undermine this trust and jeopardize the entire system. Furthermore, society in general has high expectations of scientists and science, especially in terms of expertise. It is therefore not surprising and entirely justified that the media relay to the general public the shock waves that surround such breaches. This is all the more important as once results are published, application in our daily lives may follow very quickly, meaning that fraud can have dramatic consequences for citizens. For example, the results published by researcher Anil Potti in the area of oncology, for which he was found guilty of fraud by the American Office of Research Integrity, led to unsuitable treatments being administered to certain patients. In this context, we can see that scientific integrity is an issue that reaches beyond the realms of the scientific community.

Fighting against scientific fraud

Practically speaking, breaches of scientific integrity are not always easy to characterize. In fact, alongside cases of recognized fraud, such as incidents of data fabrication and falsification and certain types of plagiarism, it is not always easy to distinguish between an unintentional error, a lack of rigor and willful deception. It is therefore

By Alain Blanchard, Professor of Microbiology at the University of Bordeaux, Head of the Mollicutes team at the Laboratory of Fruit Biology and Pathology (INRA and University of Bordeaux unit), academic advisor on scientific integrity for the University of Bordeaux.
crucial to develop and promote a true culture of scientific integrity. This means maintaining high personal and collective standards in how research is conducted, and in the monitoring processes that are implemented prior to the publication of scientific articles.

Scandals concerning scientific integrity have long affected the scientific world; the phenomenon is nothing new. Yet what is the reason for the increase we are seeing in the number of recorded violations, measured, for example, by the number of article retractions? Is this indicative of declining ethics in the scientific community? Is it simply proportional to the growing number of researchers and articles? Is it merely a reflection of the heightened vigilance of the scientific world? There are no clear-cut answers to these questions. However, a number of factors that foster this type of abuse are well known. The first is undoubtedly the pressure placed on research by increasingly fierce competition, not only between researchers seeking work, financing or recognition, but also between institutions fixated on national and international rankings. We can also blame the almost systematic use of bibliometric indicators that are at the origins of the famous motto “publish or perish”. Another factor is collaborative contexts that involve conflicts of interest and have the potential of leading to arrangements between friends, with the appearance of non-contributing authors, or that compromise the independence of researchers, particularly when financial resources are at stake.

The scientific community is taking action against these abuses

The scientific community will of course not remain passive, and is increasingly taking action in order to confront this problem. This mobilization led to the drafting and approval of various charters for national and international institutions. In France, the Conference of University Presidents and the major research organizations signed a national code of ethics for research careers in January 2015. Beyond approving this charter, the University of Bordeaux is now seeking to place the question of scientific security at the very center of its strategy. It is within this context that in late January 2016 the institution organized the first university symposium focusing on the issue with the Conference of University Presidents (CPU) and MURS-IS². The gathering brought together over 120 people and enabled exchanges on initiatives and existing good practices within the research organizations and universities. In the area of training in particular, in which the University of Bordeaux has an ambitious project for PhD students, an important work of sharing resources has now begun. This desire to put scientific integrity at the heart of the strategy of the University of Bordeaux goes beyond the institution’s ambition for scientific excellence. It stems from the desire to be an active and responsible participant in society.

Our aim is to preserve the indispensable relationship of trust between citizens and the scientific community.

Our aim is to preserve the essential relationship of trust between citizens and the scientific community, so that our work and expertise may continue to inform the decisions of leaders in charge of public policy.

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2. Universal Movement for Scientific Responsibility – Scientific Integrity
A major public building in Bordeaux since early in the Third Republic, the Faculty of Medicine and Pharmacy was constructed from 1880 to 1888 by the renowned architect Jean-Louis Pascal. Two statues on either side of the facade form a symbolic pair: Nature (left) revealing herself to Science (right). Five busts are positioned beneath the five large windows of the central avant-corps and represent five of the great global figures of Medicine and Science.
In Bordeaux, a Beaux-Arts style building that pays tribute to science, the city and the country.

Strolling through the Place de la Victoire, in the southern district of Bordeaux, visitors systematically stop in front of the human sciences faculty building. Their attention is initially drawn to the impressive 19th century facade, before examining the many architectural subtleties that are typical of the Beaux-Arts style.
A late form of neoclassicism and eclecticism, arising directly from the style of Napoleon III, the Beaux-Arts style (which derives its name from the academy and school of the same name) is characterized by a skillful blend of styles. A monumental and spectacular design—often reserved for public buildings—associated with ornamental forms borrowed from Antiquity. These are visible in the architectural details of statues, garlands, interlacing, pilasters, as well as in the columns, pediment and capitals.

Medallions from antiquity representing great doctors, anatomists, and Bordeaux professors adorn the main courtyard.

The first floor of the building features an impressive entrance hall punctuated by Ionic columns, typical of the Beaux-Arts style. Between the columns, wide staircases with marble guardians lead to the auditoriums.

Source: Livraisons d’histoire de l’architecture, Anne Richard Bazire www.lha.revues.org
The magnificent floor was created by the famous Venetian mosaicist of the Paris Opera: Giandomenico Facchina. In the center, the mosaic depicts the motto Pro Scientia, Urbe et Patria (For Science, the City and the Country).

The library, located on the second floor, is a remarkable room that has preserved its beautiful, sober decor, much to the delight of studious young people...

Beaux-Arts architecture was developed with the introduction of new techniques and materials that Pascal did not hesitate to use in improving the construction of his building: the possibilities created by the metal structures provide a modern aspect without breaking with the Beaux-Arts ornamentation. The architect favored mixed construction methods using iron and stone. The staircase has a French-style iron and cast iron stringboard and a wrought iron baluster with characteristic details. This medallion represents the three interlaced crescents that symbolize the city of Bordeaux.
The challenge of digital sovereignty

In a cyberspace totally dominated by the United States, can France make a comeback? Let’s find out.

There is a before and after Snowden. The revelations of the former CIA and NSA employee on the mass surveillance carried out by “Five Eyes” (USA, Canada, Great Britain, Australia and New Zealand) shook up public opinion and the views of political leaders on data protection. “Before, people thought we were paranoid, conspiracy theory followers,” explains François Pellegrini, Vice-President in charge of Digital Technology at the University of Bordeaux and a researcher with the LABRI and INRIA. “Now they listen to us.” Gone are the days of the yes men. All around the world, governments, companies and public opinion seem to be taking stock of the cyber-attacks that are a constant threat to national security, economic activity and individual privacy.

A worldwide security challenge

In 2015, the number of identified cyber-attacks reached record levels. +38% worldwide in the space of one year, +51% in France, according to a study from the audit firm PwC. The economic cost of these attacks was estimated at $400 billion a year by the World Economic Forum. Over and above the financial stakes, the security of industrial control systems is also at risk. In 2010, the attack of the Stuxnet malicious software, most likely developed by the United States, in partnership with Israel, severely disrupted the Iranian nuclear program. More recently, at the end of 2014, hackers succeeded in damaging a blast furnace in a German steel company. In the worst-case scenarios, governments fear terrorists gaining remote control of networks for water distribution, telecommunications and electricity... thus paralyzing entire countries.

Multi-tenant governance

In his research, Sébastien-Yves Laurent, a professor at the University of Bordeaux specializing in security issues, has looked into the new geo-cybernetic power relationships. “Cyberspace has set new rules,” explains the researcher. “The internet was originally designed to be a free, open network. That means that all users can use and develop it. In other words, individuals and legal entities, public and private stakeholders can all legitimately participate. This multi-participant context calls into question the role of countries, who historically dominated the international system.” There is another element to be considered in power relations: “The global cyber environment is strongly polarized by the United States, by private and public stakeholders.” Some examples: while over 90% of internet traffic travels through submarine fiber optic cables, 70% of digital traffic goes through the United States. Google has a 90% global market
share, and in 2015, 77% of the software used daily in France was imported from the United States… At every level, the internet is operated under the surveillance of the Stars and Stripes.

**Regaining digital sovereignty**

How do you draw a boundary in cyberspace? The answer is encryption, the mastery of one’s data and software. With its digital law, recently adopted in its first reading by the French National Assembly, France is attempting to ensure that users have more rights. It is a form of resistance against the all-powerful GAFA (Google, Apple, Facebook and Amazon) and others, such as Microsoft. In particular, the text provides for the creation of a “Digital sovereignty commission”, whose primary mission will be to promote the creation of a sovereign operating system (OS). The law also “encourages” the use of free software in government agencies and public services. "It’s a good start," comments François Pellegrini. "We cannot blindly import products without knowing whether or not they are truly secure. This does not mean that free software is infallible, but if a problem occurs it can be remedied very quickly. In the army, if we introduce equipment that is controlled by someone else, we are automatically weakened". Despite the existence of a cybersecurity policy in France, “in practice, the complete lack of understanding of digital issues by political staff leads to major strategic errors.” The most recent failure was the idea of a "sovereign" cloud for storing data. Launched with great hopes in 2009, the project cost €75 million for… nothing. In a report by the French Parliamentary Office for Scientific and Technological Decisions (OPECST), published at the beginning of the year, the parliamentarians called for the development of "healthy computer software standards" in all areas of society, from preschool to French presidential level. Adopting good habits that protect data would be a good place to start.

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1. Central Intelligence Agency
2. National Security Agency
3. Bordeaux Computer Science Research Laboratory (Laboratoire bordelais de recherche en informatique, a unit of CNRS, Bordeaux INP and the University of Bordeaux)
4. French Institute for Research in Computer Science and Automation (Institut national de recherche en informatique et en automatique)
5. Sébastien-Yves Laurent is a Co-Director of the Master in Political Sciences “Global security and trilingual analyst” program. He also teaches at the Sciences Po Paris school of political sciences and at the Science Po Bordeaux. He is a consultant and expert on security issues, and the author of numerous publications, including the following, most recent works: Transformations et réformes de la sécurité et du renseignement en Europe (University of Bordeaux Press) and Atlas du renseignement. Géopolitique du pouvoir (Sciences Po Press)
ALLERGIES: when the immune system goes haywire

To defend itself, the human body can count on a powerful weapon: its immune system. However, when the immune system starts to fight elements wrongly identified as being harmful, such as grains of pollen, egg protein or the fragrance of a perfume, this is an allergy. One out of 3 French people are thought to be affected.

Factors

EXTERNAL
Our daily environment
Our lifestyles have changed (habitat, alimentation, textile, air quality...).

INTERNAL
Predisposition
There is no such thing as equality when it comes to allergies (heredity, weakened state).

Mechanisms

they are mainly the same, regardless of the type of allergen

Careful: this should not be confused with an intolerance, which is not an immune system reaction

Effects

Each allergic reaction has different effects, which may or may not be combined.

Conjunctivitis
Rhinitis
Skin rash, hives (angioedema and anaphylactic shock)
Headache
Asthma
Digestive disorder

Allergens

The allergic substance (generally a protein) is called an allergen. There are different types, common or very rare.

LAIT
Treatment of the effects: antihistamines, anti-inflammatory drugs, corticosteroids

Avoidance of the allergen when possible

Desensitization in order to tolerate the allergen

Immediate allergy: a few seconds to 30 minutes
Delayed allergy: 3 hours to 3 days (usually skin contact allergies)

Medicinal chemicals and substances from venom
Airborne
Food
Contact with skin

Release of substances (histamine...)

Significant inflammatory reaction

1st contact with the allergen: sensitization phase

Antigen
White blood cells
Antibodies production

2nd contact with the allergen: allergic reaction phase

Antigen
Significant inflammatory reaction

Treatments

No cure, but an alleviation of the effects.
A personalized medication is necessary

UNDERSTAND
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International Master Programs, a passport to the world

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A partnership with a heart

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The wall as an opening
International Master Programs, a passport to the world

For more than ten years now, the University of Bordeaux has understood the importance at the European level of developing International Master’s programs in partnership with institutions that are internationally recognized in their field. These programs of academic excellence often attract the best students from around the world.
hey arrive from Eritrea, Thailand, Brazil, Italy, China... from the four corners of the globe, the best students apply to these Master programs, which are often very competitive. The University of Bordeaux offers roughly twenty international Master programs (taught in English) in various disciplines. 7 of these programs benefit from European funding, 5 of which obtained the Erasmus Mundus excellence label from the European Commission. The Neurosciences Master program, for example, led by a team from Bordeaux, receives 300 applications each year (80% of the applicants are from outside Europe) for 15 to 20 selected applicants. The other programs are just as successful: the MER Master in oceanography (Science in Marine Environment and Resources), the FAME Master in chemistry and the physical chemistry of materials (Functionalized Advanced Materials and Engineering), and the ALGANT Master in advanced mathematics (Algebra, Geometry and Number Theory) and the WINTOUR Master (European Master on Wine Tourism Innovation). "In these academic programs of excellence, only 10% of applicants are chosen", explains Deborah Didio, in charge of international projects at the university’s International Office. For the majority of these programs, "students may choose between several courses of study depending on the areas they want to focus their Master on", continues Agnès Nadjar, coordinator of the European Master program, Neurasmus. "They are part of the normal curriculum of the partner universities. In neuroscience, Bordeaux is globally recognized, and the five other Master universities are also leaders in the field. We are spurring ourselves on to reach greater heights. We choose very high-level students and allow researchers from each institution to expand their horizons".

New educational tools

Bianca Barucchieri, who in 2015 obtained the ALGANT master’s degree, decided to continue with her PhD thesis at the University of Bordeaux, following a proposal from one of her professors. "I am delighted, I love the city and the network of ALGANT students in the seven partner universities is very active", says the enthusiastic 24-year-old Italian student. "Every summer we organize meetings with the different classes. We are already developing our professional networks. Establishing these Master programs of excellence has accelerated the creation of other international programs. "All the educational tools that we develop for these Master programs will benefit the others", explains Agnès Nadjar. "The enrichment for French students, who attend classes in English, is considerable. We help them save time by already mastering the technical vocabulary. Since the beginning of the 2015 academic year, the first year of the Master in Neuroscience is taught in English. This allows us to welcome Neurasmus students beginning at the Master 1 level, and also improves the curriculum for national students through these educational innovations. We rely on the educational methods used in universities of excellence, such as the universities of Göttingen and Amsterdam, to create new classes (small class sizes, flipped classrooms...). The Department of Languages and Cultures has also provided us with several tools. In the end, everyone wins".

Erasmus Mundus is a funding program of the European Commission that supports the development of high-quality academic courses (Master/PhD) between European institutions that are leaders in their field, and offers scholarships to the best students from around the world. Today, it continues within the framework of the Erasmus+ program through the Joint Master’s Degree initiative (which targets Master programs only).
Charlotte Assemat
Charlotte is a Master 2 student in Imaging Processing and Computer Vision, currently carrying out a work placement with Technicolor, in Rennes. This Master program is based on the model of integrated courses, approved by the European Commission. Coordinated by the University of Bordeaux in partnership with the Paznamy Peter Catholic University of Budapest and the Universidad Autonoma of Madrid, it is a program that awards a triple degree.

“After completing my degree in Computer Science at the University of Bordeaux, I knew that I wanted to specialize in image processing and computer vision. This international Master program, completely in English, was created just in time for me to begin my first year. And during the two years, I certainly didn’t have time to get bored! Five months in Madrid, then five months in Budapest, and a final semester in Bordeaux. The content, developed in conjunction with the different universities, is perfectly combined. In Madrid, the polytechnic school has strong expertise in the area of video surveillance with the development of person recognition software and data extraction from an image. In Budapest, we studied more theory and mathematics. In my work placement search, these international experiences had a positive impact on the recruiters. In this profession, mastering technical English is vital, and when we say we have completed 3 semesters in English, it’s a done deal”.

Nicolas Bieganski
In 2014 Nicolas earned his Master 2 degree in International Management from IAE, and spent one year at Northern Illinois University in the United States, where he also earned a degree. After one year of experience as a sales manager with the Egencia agency (Expédia group), in Paris, he now wants to pursue his ambitions internationally, and is looking for a marketing job in London.

«Thanks to the IAE partnership between the University of Bordeaux and Northern Illinois University, I had the opportunity to do an MBA and earn a dual degree. This type of training is usually very expensive, but the IAE admission fees were very affordable. In my first year in the Master program, I received approval for my project from the different IAE professors and former MBA graduates. The 7 months in DeKalb, near Chicago were very intense. We had only 15 hours of classes per week, but with an enormous amount of preparation work outside of class, including readings and group work. We ended the year with a business case. In groups of 5, we intervened as junior consultants in a local company. It was a very rich experience that has motivated me to continue my career abroad”. ■ interviewed by JZ
In Bordeaux there is a center that is unique in Europe. One of the 6 French University Hospital Institutes (IHU - see Box), it is the Electrophysiology and Heart Modeling Institute called LIRYC (in French: L’Institut de Rhythmologie et de modélisation Cardiaque), specializing in the study, diagnosis and treatment of electrical malfunctions in the heart, the cause of many cardiovascular diseases and cases of sudden deaths, of which there are over 50,000 per year in France.

Directed by Professor Michel Haissaguerre\(^1\), an internationally-recognized expert, and composed of over 120 researchers and doctors from 15 different nationalities, LIRYC has achieved major scientific advancements in the areas of ventricular and atrial fibrillation, resynchronization and heart failure.

These advancements, accomplished in part through partnerships with international industrial partners, have led to the establishment of new therapeutic strategies that have been implemented worldwide. One such advancement is a revolutionary diagnostic tool: a ‘jacket’ equipped with 250 electrodes that are connected to a computer, like an electrocardiogram, designed and developed in the United States by CardioInsight, the only start-up in the world to have succeeded in placing this type of device on the market. On the other side of the Atlantic, in Bordeaux, the LIRYC signal processing team developed a new method for the non-invasive three-dimensional mapping of the heart’s electrical activity. A collaboration agreement has been signed between the company and the IHU. As Rémi Dubois, the head of LIRYC’s signal processing division, explains: “our highly transdisciplinary expertise was the missing piece of the puzzle for their system. This collaboration and complementary exchange of knowledge and expertise has provided the “jacket” with true diagnostic capacity that is now effective for diseases related to atrial fibrillation, yet it still has great potential for development.” 900 patients have already benefited from this tool in the framework of the research. Eventually, this technology should make it possible to predict undetectable heart attacks, thus saving thousands of lives each year.\(^{■ SBS}\)

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\(^1\) University Professor and a hospital practitioner at Haut-Lévêque Hospital, Head of the Cardiac Electrophysiology Department of the Bordeaux University Hospital (CHU), Director of the LIRYC University Hospital Institute, member of the Academy of Sciences and the Academy of Medicine.

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**What is an IHU?** University Hospital Institutes (in French, Instituts hospitalo-universitaires – IHU) are centers of scientific and medical excellence with a four-fold mission of treatment, research, innovation and education...

Each IHU brings together, to a single location, academic research teams and medical teams working directly with companies. Excellence and attractiveness are at the heart of the University Hospital Institutes, which are supported by the French Investments for the Future program. The international influence of the IHU network increases each year through new collaborations and partnerships...
W

ith Operation Campus Bordeaux, the campuses have continued to function alongside construction work that has greatly changed the landscape since 2009. The university community and residents have not yet truly claimed ownership of these changes. As part of the program for the worksites, the different construction work planned for the Pessac sector will provide the opportunity to recover these spaces and create true living spaces.

Mural paintings on the prefabricated buildings and the Law and Literature university library, workshops for discovering graffiti art, art exhibitions, a discovery course on real estate, and the installation of a container to be used as an information center for the construction work... these creations will make the walls of the Pessac campus come to life with the Station Campus project. Discover this initiative from April to October 2016.

Street art, bringing together university and urban territory

By definition, street art is an art form expressed in public spaces. It encourages us to stop and look at the same thing together; it raises questions. “By building on street culture and the everyday life of residents and the university community, we seek to help them discover and understand the building and development project by awakening their curiosity,” explains Marco Franchi, in charge of territorial development and quality of university life at the University of Bordeaux. “Especially since street art is a territorial marker that we can build on”, she added. Urban art is indeed in the limelight in the Bordeaux metropolis. The city of Pessac is planning a series of highly visible cultural events (Editor’s Note: Vibrations Urbaines event in October) and the artist group TRANSFERT produces original works in Bordeaux that provide viewers with a visual getaway. Typically used to enclose space, the walls of the Pessac campus will become tools for expression and appropriation.

Like a destination, a metro entrance in Paris or elsewhere, Station Campus will create a stop, a time for experiencing the campus differently, a time to stop and create, discover, and participate. Next stop... Station Campus. ■ CP

Station Campus is a project led by the artist group TRANSFERT with the University of Bordeaux and the city of Pessac, in cooperation with Bordeaux Montaigne University, the Aquitaine CROUS, Bordeaux Métropole and the Aquitaine-Limousin-Poitou-Charentes region.
Your potential lies in Bordeaux

What our international visitors say about the University of Bordeaux*

- 85% rate our research laboratories as leaders within their field
- 85% value our network of high level scientists
- 79% acknowledge the scientific expertise of our university
- 83% consider us as an attractive university

*IPSOS study conducted between June and September 2015 among 452 international students, PhD students and researchers

More information about our opportunities for junior academics or confirmed researchers on www.u-bordeaux.com/be-come-become