

L'Édition of Université Paris-Saclay spring 2023

Issue

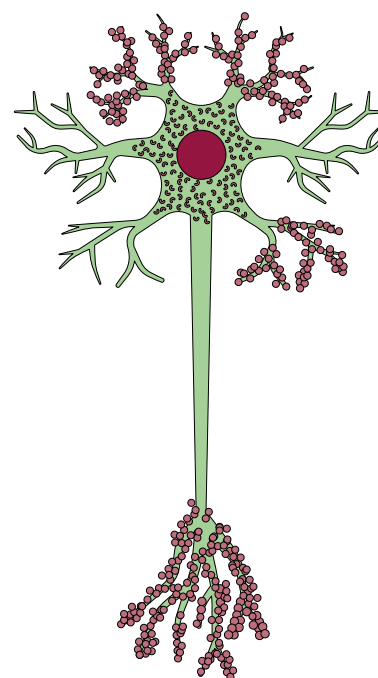
21

Section and theme

Research – Alzheimer's disease

Page

21



Section

Teaching, learning

Page

04

Section and theme

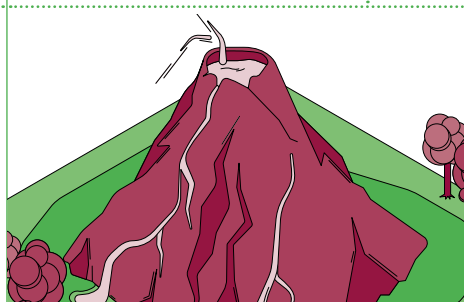
Research – Fluid dynamics

Page

13

Title

STUDENT TUTORING AND MENTORING: RESOURCES FOR SUCCESS



Section

Science outreach

Page

07

Section and theme

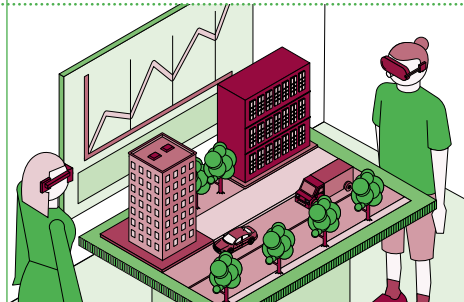
Business & Innovation – PEPR

Page

16

Title

HUGO DUMINIL-COPIN MEETS STUDENTS FROM THE AREA



Section

Seen from abroad

Page

25

Title

COP27: GO AND SEE IT TO BELIEVE IT

Section and theme

Research – Child and teenage
psychiatric disorders

Page

10

Section and theme

Research – Spintronics

Page

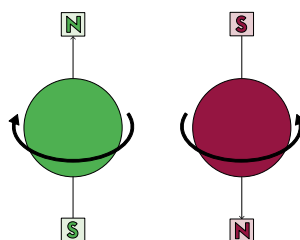
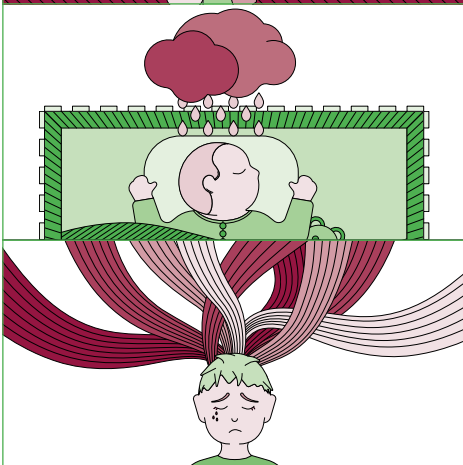
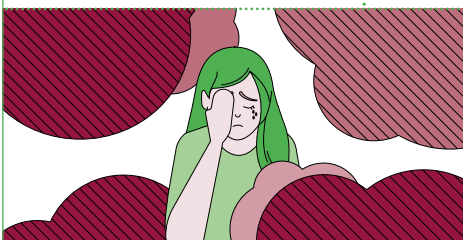
18

Section

Campus life

Page

27



Title

A SOLIDARITY CENTRE IN THE ORSAY VALLEY

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PRIZES & AWARDS



RESEARCHERS	STUDENTS	COMPANIES/ PROJECTS
<p>Michel Beaudouin-Lafon, researcher at the Interdisciplinary Laboratory of Numerical Sciences (LISN – Univ. Paris-Saclay, CNRS, CentraleSupélec, Inria) has been appointed ACM Fellow by the Association for Computing Machinery (ACM), in recognition of his contributions to the discipline of human-computer interaction.</p>	<p>Cléophanie Brochard, PhD candidate at the Centre for Nanoscience and Nanotechnology (C2N – Univ. Paris-Saclay, CNRS, Univ. Paris Cité), was awarded the prize for the best poster of the Alain Bouyssy colloquium, co-organised by the Graduate Schools Physics and Engineering and Systems Sciences of Université Paris-Saclay.</p>	 <p>© Université Paris-Saclay</p>
 <p>© Benoit Granier/pm.gouv.fr</p>	<p>Eva Criou, a student at Université Paris-Saclay, was crowned French university karate champion in the under 61 kg category and will represent France at the European Universities Championships in July.</p>	<p>During the Student Entrepreneurship Day (JEE), co-organised by Université Paris-Saclay and the Pépite PEIPS, the Île-de-France region, the Paris-Saclay urban community and the Start-in Saclay association, three projects by Université Paris-Saclay students were rewarded during the pitch competition: CryoTransplant led by Rose Cahagne, Buddi Flashcards led by Valentine Quiniou and the ScreenMe project by Eva Derabanne. The Forest Data Manager project by Mathieu Penet, a student at AgroParisTech, received the Essonne CCI's "Coup de Cœur" award. MooveToi, a project by Université Paris-Saclay student Néva Beraud-Peigne, received the BNP Paribas "Coup de Cœur" prize. Lastly, the IncubAlliance "Coup de Cœur" prize was awarded to Dimitri Marceau, a student at Institut d'Optique Graduate school, for his Digi'Skin project.</p>
<p>Ghislaïne Dehaene-Lambertz, Director of the Developmental Neuroimaging team within the Cognitive Neuroimaging Unit (UNICOG – Univ. Paris-Saclay, Inserm, CEA, CNRS) of NeuroSpin, was honoured with the rank of Knight of the Legion of Honour (Chevalier de la Légion d'Honneur) by Charlotte Caubel, Secretary of State for Children. This honour recognises the paediatrician's career and her work on brain mechanisms in babies and young children.</p>	<p>Giuliano Giacalone, a PhD candidate at the Institute of Theoretical Physics (IPhT - Univ. Paris-Saclay, CNRS, CEA), has been awarded a prize by the European Physical Society for his thesis, defended in November 2020, on the observation of nuclei in a high-energy collider.</p>	<p>Ten start-ups attached to Université Paris-Saclay were included in Challenges magazine's list of 100 start-ups to invest in 2023: Beams, co-founded by Laurent Ménard, a researcher from the Laboratory of the Physics of the two Infinities – Irène Joliot-Curie (IJCLab – Univ. Paris-Saclay, CNRS, Univ. Paris Cité); Circul'Egg, co-founded by Yacine Kabeche, a former student at AgroParisTech; Fairbricks, co-founded by Tawfiq Nasr Allah, a former PhD candidate at the Molecular Chemistry and Energy Catalysis Laboratory (LCMCE) within the Nanosciences and Innovation for Materials, Biomedicine and Energy Unit (NIMBE – Univ. Paris-Saclay, CEA, CNRS); Ion-X, co-founded by Jacques Gierak, researcher at the Centre for Nanoscience and Nanotechnology (C2N – Univ. Paris-Saclay, CNRS, Univ. Paris Cité); Imescia, co-founded by Julien Nicolas and Nicolas Tsapis, researchers at the Paris-Saclay Galien Institute (IGPS – Univ. Paris-Saclay, CNRS); Kimialys, co-founded by Claude Noguès, researcher at the Laboratory of Biology and Applied Pharmacology (LBPA – Univ. Paris-Saclay, ENS Paris-Saclay, CNRS); Kanop, co-founded by Louis de Vitry, CentraleSupélec alumnus; Néolithe, co-founded by Clément Bénassy, AgroParisTech alumnus; ZALG, co-founded by Tanguy Gestin, AgroParisTech alumnus; Opus Aerospace, co-founded by Safouane Benamer, alumnus of the Atmospheres, Environments, Space Observations Laboratory (LATMOS – Univ. Paris-Saclay, UVSQ, CNRS, Sorbonne Univ.).</p>
<p>During the Alain Bouyssy colloquium, co-organised by the Graduate Schools Physics and Engineering and Systems Sciences of Université Paris-Saclay, Thibaut Houdy, from the Laboratory of the Physics of the two Infinities – Irène Joliot-Curie (IJCLab – Univ. Paris-Saclay, CNRS, Univ. Paris Cité), received the Best Presentation Award for his presentation of neutrinos and dark matter. Corentin Morice, from the Laboratory of Solid-State Physics (LPS – Univ. Paris-Saclay, CNRS), received the same award for his presentation on topological matter.</p>	<p>Three teams from the UVSQ 2nd-year Master's in High-Performance Computing and Simulation (CHPS) finished in the top three in the first programming marathon (hackathon) organised by Teratec in December 2022. The teams of four students were composed of Benjamin Lozes, Guillaume Bigand, Ugo Battiston, Mathys Jam (1st place), François-Xavier Mordant, Gabriel Dos Santos, Fiona Santoro, Candice Astier (2nd place), and Sirata Kone, Nicolas Dias, Alexis Laplanche, Chustpa William Yeumo Barwende (3rd place).</p>	
<p>Araceli Lopez-Martenz won the 2023 CNRS Silver Medal. The researcher from the Laboratory of the Physics of the two Infinities – Irène Joliot-Curie (IJCLab – Univ. Paris-Saclay, CNRS, Univ. Paris Cité) specialises in the internal cohesion of atomic nuclei.</p>	 <p>© FFSU</p>	
<p>Frank Merle, chair in Analysis at CY Cergy Paris University-IHES, and Pierre Raphaël, Schlumberger Chair for Mathematical Sciences at IHES, have both been awarded the 2023 Böcher Memorial Prize by the American Mathematical Society.</p>	<p>Two students from Université Paris-Saclay, Rayanne Mannai and Enzo Compelle, finished second in their respective categories (under 88 kg and under 63 kg) at the end of the French university taekwondo championship.</p>	

EDITOR'S LETTER



© Angélique Gisson / Université Paris-Saclay

As the academic year is coming to an end, there has been a lot of news since early spring, such as the John Bates Clark Medal awarded by the American Economic Association to Gabriel Zucman, a 2009 alumnus of the École Normale Supérieure Paris-Saclay, a doctor of economics from the EHESS and an expert on tax evasion, high-income taxation and social inequality. For this issue, *L'Édition* has been provided with some additional pages.

Last April, the French and Canadian governments set up a Joint Franco-Canadian Committee on Science, Technology and Innovation

to strengthen the long-standing partnership on research and innovation between our two countries. On behalf of Udice, which brings together ten major French universities, I signed on this occasion a joint declaration intended to develop strategic research and training collaborations and partnerships between French and Canadian universities, and to promote joint research projects, the mobility of students and scientists, joint training programmes and research chairs. As a member of the strategic council of this Committee, I was honoured to represent the French research universities and in particular to recall the central place of partnerships between the universities of the two countries in the implementation of a common scientific strategy, and to propose the development of interdisciplinarity within priority topics, such as health, artificial intelligence or quantum physics.

These disciplines are currently the focus of research at Université Paris-Saclay. In this issue of *L'Édition*, you will find new aspects of our scientific activities with a theme devoted to spintronics, from the discovery of the giant magnetoresistance effect by Albert Fert in 1988, for which he was awarded the Nobel Prize in Physics in 2007, to the many emerging fields (magnonics, oxytronic, orbitronics, etc.) and their possible new applications, which are intended to be energy-efficient. You will also discover a portrait of Alzheimer's disease as studied by researchers at Université Paris-Saclay. The development, identification and treatment of this neurodegenerative disease are major research areas at the University.

This issue of *L'Édition* also presents a broad overview of the various priority research programmes and equipment (PEPR), in particular those close to Université Paris-Saclay, which are being deployed as part of the "France 2030" investment plan initiated by the Government and which are intended to develop the technologies and industry of tomorrow, while consolidating French scientific and technological leadership.

You will also find out about the latest advances in research on psychiatric disorders in children and teenagers; disorders that are too rarely studied in a context where research in child psychiatry suffers from a general invisibilisation. At the same time, you will discover the notion of eco-anxiety, a disorder born of climate inaction that strikes young people in particular. Fluid dynamics and the need for a better understanding of the way our planet works are also featured in this issue.

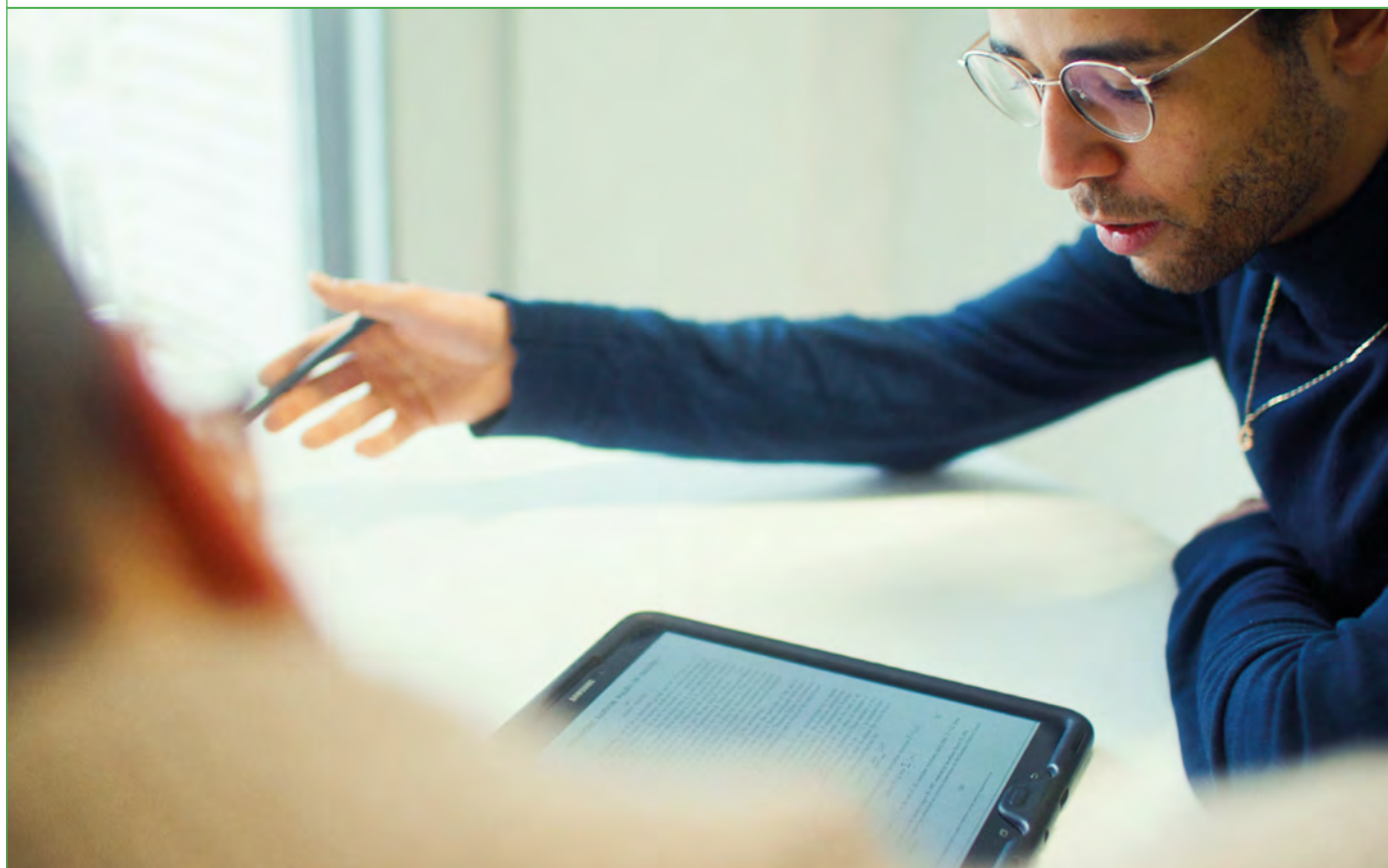
This is how this spring issue of *L'Édition* takes shape, where student associations and tutoring programmes are also in the spotlight.

We wish you a great summer and hope you will enjoy reading *L'Édition*!

Estelle Iacona,
President of Université Paris-Saclay.

Title

Student tutoring and mentoring: resources for success



© CC BY-SA / Orsay Faculty of Sciences

Since 2020, Université Paris-Saclay has been designing and providing various different tutoring and mentoring schemes. The goal is to contribute to the success of students and to fight against precariousness and isolation. Whether they are aimed at undergraduate students, newcomers or specifically female doctoral students, these innovative actions are widely acclaimed.

The origin of the multiplicity of these tutoring and mentoring actions lies in a proven statement: student success and the construction of a study or integration project is not based solely on obtaining a diploma. *“These actions also require the acquisition of other types of skills, such as openness to the world and to others, autonomy and self-confidence, which are essential for self-fulfilment and for projecting yourself into the future,”* explains Pascal Aubert, director of the Paris-Saclay undergraduate school and deputy vice-president of Université Paris-Saclay. However, even though the University’s professors are the first referents

for students, they are not always able to respond to all their needs.

It is precisely at these moments that the presence of a tutor or a mentor, available and specifically devoted to this purpose, can be effective in complementing the existing educational and administrative system. *“It is clear that peer coaching is a particularly virtuous approach. We should therefore do everything we can to support the more advanced students who want to help those following them in overcoming the obstacles they may have encountered themselves during their studies,”* adds Fanny Binois, lecturer in private law and head of the educational referral service at the Jean Monnet Faculty (Law – Economics – Management). Université Paris-Saclay and its various components are aware of the tremendous leverage for success that these tools represent, and provide a number of different programmes for those who so wish, from undergraduate to doctoral level.

Navigating the undergraduate jungle

If there is a time in a university curriculum when one can feel overwhelmed, it is during the first years of study. In order to meet these

needs, the “Student Life Tutoring” programme was set up in 2020, run by the Department of Student Life and Equal Opportunities (DVEEC). The goals of the programme are to inform students about the University’s offers, services and support mechanisms in all areas of student life, to support people in vulnerable situations by identifying emergencies and directing people to the appropriate services, to provide ideas and suggestions for action, and to coordinate appropriate student employment. *“As part of this scheme, two types of tutors are recruited to support undergraduate students who wish to make use of it: student life support staff attached to university components and various different support services and departments, whose mission is to provide an initial general and local welcome on campus, and then ambassadors specialising in specific topics (social, housing, disability, health), whose mission is to go out and meet students throughout the year,”* explains Hervé Rivières, director of the DVEEC.

Beyond the logistical aspects, undergraduate students may also feel the need for more disciplinary or methodological support. *“In law school, where repetition rates are high in the first few years, we are receiving more and*

more requests along these lines. This is why we decided in 2021 to set up, within the Jean Monnet Faculty, a peer tutoring system with students from the first and second years of Master's degree programmes for first and second-year undergraduates," says Fanny Binois. These tutors are present for two hours a week in each of the three divisions of the Faculty to answer methodological questions from their younger students, to go over points in the course that were not understood, and to allow individual contact with the educational referents or the orientation and professional insertion centre, if necessary. *"In light of the very positive feedback we have received, we are working on expanding this programme, which we are convinced is a very effective lever for success,"* adds Fanny Binois.

Guides for international students

When they arrive in their first or second year of a Master's degree, new international students are also very much in need of support. The Graduate Schools of Mathematics, Life Science and Health (LSH) and Chemistry are thus becoming increasingly involved in facilitating connections between these newcomers and older students, as well as with lecturers who are willing to help them. *"These actions are supported by the 'Structuring training through research in initiatives of excellence: training, learning, innovating through research' (SFRI-FAIR) programme,"* says Elisabeth Dufour-Gergam, vice-president of cross-disciplinary training and career planning at Université Paris-Saclay.

"This year, for the first time, we are deploying tutoring and mentoring actions for 24 new students at the LSH Graduate School. We wanted these actions to be complementary to what is on offer in the Buddy Programme, which tutoring candidates have to register for first," says Marie-Anne Debily, Deputy Director of International Relations at the LSH Graduate School. *"The Buddy Programme is an action by the International and European Relations Department (DRIE) that complements what the Graduate School does. Its mission is to connect new students with older ones who are available during the summer to answer questions, welcome them when they arrive, help them get settled, open a bank account, find their way around the buildings, etc.,"* explains Elisabeth Dufour-Gergam.

Within the framework of the tutoring programme organised by the Graduate School, the tutors are recruited from the 2nd-year Master's degree or PhD programme, and thus belong to the same field of study – Health Biology – as the beneficiaries. *"They can help*

people find their way around the buildings where their course is taught, and remain available throughout the year to answer their questions, particularly in relation to the course they are about to embark on," explains Slavka Kascakova, who is in charge of the tutoring mission at the LSH Graduate School. For discussions of an educational nature, choice of internship or professional orientation, newcomers who are being tutored can also benefit from the support of a mentor lecturer in the field.

Building up a career strategy with a mentor when you are a woman

Another programme that meets a specific need is the "Women in Science" mentoring programme, which is open to all female doctoral students at Université Paris-Saclay. *"This programme was born out of the realisation that it is not easy for a woman scientist to build up an ambitious international career, especially at an age when motherhood is also an issue. This is why every year we set up about 50 pairs, enabling PhD candidate mentees to be accompanied by a mentor from the academic or private sector,"* explains Géraldine Liot, who co-leads the programme with Jessica Andreani and Gwenaëlle André. This support takes the form of individual meetings for each mentor/mentee pair, discussion circles among mentors and mentees, and workshops on public speaking, how to succeed in a job interview, and how to master networking tools. *"While the programme has been running at full speed for four years now, we are currently working on building up a network of alumni,"* says Géraldine Liot.

"This programme was born out of the realisation that it is not easy for a woman scientist to build up an ambitious international career."

Géraldine Liot

Tutoring: a highly popular win-win strategy

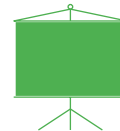
If tutoring actions meet a need of students, they are also appreciated by the numerous tutors, both paid and volunteers, who are involved. *"It's amazing to see the spirit of solidarity expressed in this type of action. One year, we received 42 applications for only 6 tutor positions,"* says Fanny Binois. The success of the "Cordées de la réussite" programme, in which students volunteer to help those still

at secondary and 6th-form schools, is proof of this enthusiasm for tutoring. *"We believe that this kind of engagement develops the openness of our students and contributes to their confidence. This is why we are considering the question of their training by drawing up a charter and promoting their commitment,"* concludes Pascal Aubert.

<https://www.universite-paris-saclay.fr/programme-de-mentorat-femmes-sciences>

<https://www.universite-paris-saclay.fr/vie-de-campus/vie-etudiante-et-associations/le-tutorat-vie-etudiante>

<https://www.universite-paris-saclay.fr/luniversite/diversite-egalite-inclusion-handicap/legalite-des-chances-avec-les-cordees-de-la-reussite>



Title

The second year of the Master's degree in Public Policies and Strategies for Sports Organisations opens up to work-study programmes

Firmly anchored for the past twenty years in the training provided by the University, the second year of the Master's degree in Public Policies and Strategies for Sports Organisations (M2 PPSOS) will now be open to work-study programmes from the start of the academic year 2023-2024. Almost unheard of in France, the PPSOS program aims to train specialists who know how to link public policies (national, local, etc.) and the strategies of sports organisations (federations, leagues, clubs, etc.). *"This Master's degree holds an original position in the design and management of sports facilities and spaces. About fifteen years ago, we decided to broaden the scope of the course, in particular to include all kinds of sports policies and strategies for sports organisations,"* points out Dominique Charrier, co-leader of the PPSOS. It was in line with this idea that we decided to open the second year up to work and study."

"The priority is professionalisation and we believe that work-study programmes are an excellent tool for this."

Dominique Charrier

"However, the degree is also available for initial training," says David Sayagh, co-director of the programme. *"The coming academic year will begin with a common integration week, and working students will join their host structure on Mondays and Tuesdays. By April, all students will be full-time apprentices or interns."* There are various different partner structures in the training programme: municipalities and urban communities (Saint-Quentin-en-Yvelines, Paris-Saclay, Plaine Commune), the Essonne department, the city of Paris, numerous federations, the National Sports Agency, etc. Each year, they send privileged offers for internships, apprenticeships and jobs to the two heads of training.

The students, a maximum of 25 per class, also benefit from solid supervision. *"The priority is professionalisation and we believe that work-study programmes are an excellent tool for this. We also make a great effort to support students. In terms of job opportunities, the employment rate six months after graduating from the PPSOS is over 90%, more than half of which are permanent contracts,"* notes Dominique Charrier.

Applications for this Master's degree, by means of files and interviews, will be open from 1 May to 1 July 2023.

<https://www.universite-paris-saclay.fr/formation/master/staps-management-du-sport/m2-politiques-publiques-et-strategies-des-organisations-sportives-ppsos>

Title

New multidisciplinary graduate programme (CPES) at Université Paris-Saclay



© Lucie Locqueneux

The start of the academic year 2023/24 will see the arrival of a new excellence graduate programme in the Université Paris-Saclay landscape: the multidisciplinary graduate programme (CPES) "Data Science, Society and Health".

The result of a synergy between Université Paris-Saclay, the École Normale Supérieure Paris-Saclay, the Polytechnic Institute of Paris, HEC Paris and the International High School of Palaiseau Paris-Saclay, the CPES "Data Science, Society and Health" opens its doors at the start of the academic year 2023-2024. It will accommodate up to 50 students, at least 40% of whom will be on a scholarship.

A CPES is a training programme for young baccalaureate holders, recently added to the French higher education ecosystem. It

takes three years to complete and leads to a Bachelor's degree. It generally consists of a mixed team, whose members are from high school and higher education, includes training through research as early as possible, and provides for the gradual participation of higher education in the training. A CPES combines the requirements of the preparatory studies for the Grande École (CPGE) with the pace and learning methods of a Bachelor's degree.

The multidisciplinary CPES "Data Science, Society and Health" will allow students to approach the issue of data from many different angles over a period of three years. The use of artificial intelligence (AI), mathematical and computational tools, and the understanding of various uses (health, economics, sociology, business, etc.) lie at the heart of this course. The CPES thus responds to an ever-increasing demand for training in the field of AI and its uses, and opens the door to a wide variety of further studies in data science.

https://www.ac-versailles.fr/sites/ac_versailles/files/2023-01/pr-sentation-de-la-formation-cpes-sciences-des-donn-es-soci-t-et-sant-paris-saclay-37723.pdf

Title

Hugo Duminil-Copin meets students from the area, in the places where he grew up



© Christophe Peus

On 19 and 20 April, over 500 secondary and high school students from the Massy area (Essonne) had the opportunity to meet Hugo Duminil-Copin, a professor at the Institut des Hautes Etudes Scientifiques (IHES) and the University of Geneva, and Fields 2022 medal winner, at two talks specially organised for them in the region. The talks were a blend of personal history and motivations, the playful and creative aspects of mathematics, and overturning preconceived ideas. All this was a source of great pleasure for the young participants and the teaching staff present.

“I had been talking to my father for a while about organising a talk in the area. The Fields Medal and the media coverage of this award have no doubt speeded everything up. I wanted one of my first talks to be in the place where I grew up,” says Hugo Duminil-Copin, winner of the highest distinction in mathematics in 2022 for his work on the theory of percolation. *“Hugo always told me that he would like to give a presentation to the students of the Secondary school of the Guyonnerie, in Bures-sur-Yvette, where he himself went to school. I wanted to make this wish come true after he won the Fields Medal,”* confirmed François Duminil, Hugo’s father and Vice-Principal at Alain Fournier high school in Orsay.

On 19 April, 370 secondary school students from the Massy area (Essonne) and their fifty or so accompanying adults had the pleasure of meeting the mathematician at a lecture given in their honour in the Michelin amphitheatre of the Bouygues building at CentraleSupélec, right in the heart of the Université Paris-Saclay campus. Organised by La Diagonale,

in collaboration with the IHES and the Regional Board of Education of Versailles, the meeting was chaired by the journalist Fred Courant, from L’Esprit Sorcier. The next day, nearly 160 students from the Massicois area attended a second talk, organised for them at the High School of the Chevreuse Valley, in Gif-sur-Yvette.

Initially intended for the two secondary schools in Orsay and Bures-sur-Yvette, these talks eventually involved all the secondary schools in the Massy region, i.e. 22 secondary schools and 12 6th-form colleges. *“We left it up to each school’s maths team to decide which classes to target and which students to involve,”* says François Duminil.

Two approaches, one goal

Lasting one and a half hours, each talk was divided up into a presentation by Hugo, a presentation of his background, his profession and his research topic, and a question and answer session with the audience. However, the approach used for each talk was different. The talk for 6th-form students was more scientific, *“less about entertainment,”* admits Hugo. It focused more on his research work, which is about phase transitions, the abrupt changes of matter in relation to mathematics. *“I am specifically studying phase transitions in porosity models and those related to magnetism. For example, the fact that when you heat up a magnet, it loses its magnetisation.”*

Talking to the students, the mathematician started from the game theory to bring the students to the percolation theory, the notion of random labyrinth. *“I used the Hex game for this. Hex is a strategic board game for two players, the hidden manifestation of percolation. Before the conference, I handed out a little booklet to the students to explain the game.”*

At the end of the event, the young students were ecstatic: *“I found the demonstrations very interesting, he explained mathematics to us while remaining very accessible. It makes you want to do math!”* summarizes a schoolgirl.

Scientific mediation: the other side of the same passion

If popularising his research is not an easy task, it is one that lies close to the heart of the Fields

2022 medal winner. *“It’s an exercise I love, even if I sometimes feel like an impostor because it’s not my job. It’s a complicated task that requires a lot of work, especially in the area of mathematics, because you have to find the right balance between talking enough about mathematics and not losing your audience,”* he says. *“Coming from a family where education is important – it is my parents’ profession and also my wife’s – the handing down of knowledge is fundamental for me, at all levels.”*

Hugo does not conceal his other ambition: to shatter the image all too often associated with mathematics. *“We often see it as something inhuman, because of our memories of somewhat disembodied theorems. What I would like to show is that, on the contrary, mathematics leaves room for creativity and that personal taste is important.”* This ambition echoes the work of scientific mediation initiated at Université Paris-Saclay. *“When I was young, I didn’t have too many images of scientists or even people just working in science,”* he recalls. *“I would like to show that a scientist is someone who can laugh and joke, and be enthusiastic about his results. A scientist is a man or woman who leads a normal family life.”*

While 2023 has been declared a “year of promotion of mathematics in schools” by the Ministry of National Education and Youth, and the teaching of mathematics is struggling somewhat in France, Hugo would not be against finding vocations. *“I think that science outreach can be a real help to teachers to rehabilitate mathematics, to show that it is not only a matter of exams and marks,”* he concludes.

https://www.youtube.com/watch?v=d2aa3nnQYz-M&ab_channel=Universit%C3%A9Paris-Saclay



Title

IconLab: boost your scientific mediation!



© Université Paris-Saclay

The IconLab project, led by La Diagonale, aims to support the Université's scientific community with audiovisual projects dedicated to scientific mediation. *"Scientists do not always have the right tools to understand the documentary format,"* says Jean-Hugues Berrou, a documentary film-maker in charge of a documentary writing workshop at SciencesPo Paris and a participant in the project.

The IconLab offers education in audiovisual techniques, writing and production support. It also includes the provision of equipment in collaboration with the Université's Lumen Learning Center and supports audiovisual project leaders. *"The IconLab is not only an educational space, it is also an interdisciplinary crossroads conducive to the development of collaborative projects,"* confirms Charlène Corty, Head of Science-Society Projects at Université Paris-Saclay

The IconLab is open to lecturers, researchers, PhD candidates and administrative staff and has already encountered great success after just one year of existence. The initiative also offers joint screenings and training, in association with the Pariscience International Science Film Festival. A new programme focusing on speaking and argumentation in front of the media and the camera will be offered at the beginning of the 2023/24 academic year. Interested parties are encouraged to take advantage of this opportunity!

<http://www.sciencesociete.universite-paris-saclay.fr/decouvrir/iconlab/>

Title

"Rendez-vous des jeunes mathématiciennes et informaticiennes" moves to ENS Paris-Saclay



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The "Rendez-vous des jeunes mathématiciennes et informaticiennes" (Rendez-vous for young mathematicians and computer women scientists – RJMI), which has already been held at Inria Saclay, took place at ENS Paris-Saclay for the first time on 11 and 12 March 2023.

Supported by the associations Animath and Femmes & Mathématiques (Women & Mathematics) in collaboration with students and PhD candidates from the ENS, this event gives high school girls who are passionate about mathematics and computer science the opportunity to discover higher education and research, participate in scientific workshops and discuss and share their experience as young women interested in these fields. *"The aim is to boost the enthusiasm of these young girls and encourage them to consider ambitious scientific studies,"* emphasises Claire Lambard, Head of Equality at ENS Paris-Saclay and logistical and organisational support for the event. There will also be round tables with women with established scientific careers, such as researchers, lecturers and unit or department heads, so that the girls can learn more about their backgrounds and the challenges they face as women.

This year's events at ENS Paris-Saclay were supported by several sponsors, such as the Crédit Agricole Île-de-France and Magic LEMP, an artificial intelligence start-up founded by former ENS Paris-Saclay students. Marie Chupeau, co-founder of the start-up and former

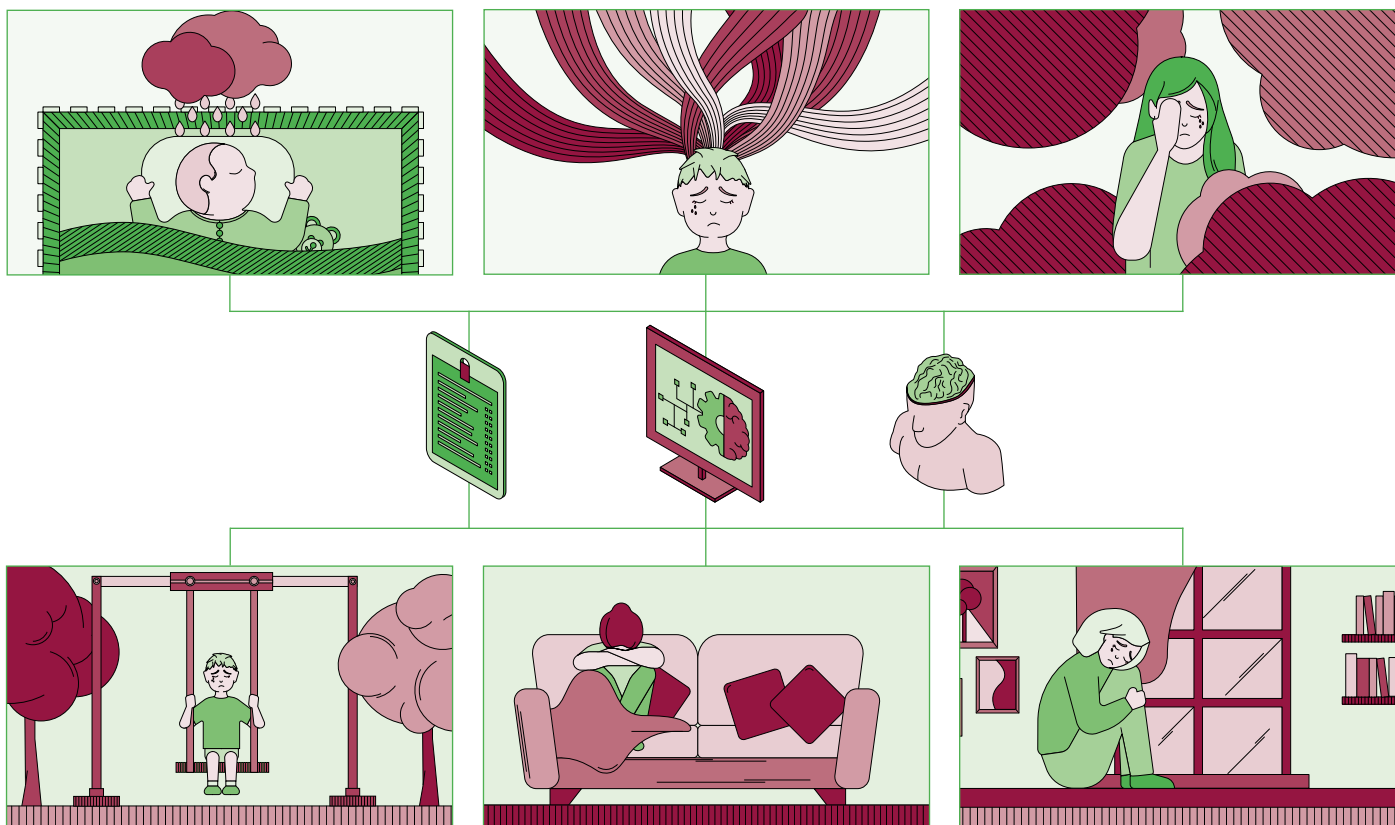
ENS Paris-Saclay student, took part in one of the round tables, adding to the professional panorama offered to the young high school girls and feeding into their reflections on their future.

<https://filles-et-maths.fr/rjmi/#presentation>



Title

Child psychiatric disorders: changing trajectories at an early age



Many psychiatric disorders begin in childhood and adolescence. Child psychiatry research involves identifying these signs as early as possible and following up on young patients so that serious consequences never occur.

By definition, child psychiatry is the medical discipline that addresses mental illness in children and teenagers. Its origins can be traced back to the early 19th century and the work of Jean-Marc Itard on Victor of Aveyron, the wild child discovered in nature in 1797 and later diagnosed as having autism spectrum disorders. However, it was not until 1973 that the first French institutional degree in child psychiatry was created. However, there are fundamental differences between the psychiatric study of adults and children, according to Bruno Falissard, child psychiatrist and Director of the Centre for Research in Epidemiology and Population Health (CESP – Univ. Paris-Saclay, UVSQ, Inserm). “First, a child’s psychiatric development is not the same at different ages, as a child is always changing. So, for example, depression is different in a newborn, in a young

child and in a teenager. The central issue in child psychiatry is development. Studies in children are therefore sized according to this principle,” the researcher explains. “Second, when we talk about children, we are also talking about parents. The child is studied systemically (we have to consider the child at school, with their family, etc.), while the adult will be studied in a more isolated way (perhaps wrongly). Child psychiatry research is more complex than psychiatry research, and therefore less common.”

Child psychiatrist and CESP member Alexandra Rouquette stresses the particular benefit of studying mental disorders in young patients: “The various disorders that can be diagnosed at young ages, which are not necessarily labelled immediately, are not stable. The benefit of child psychiatry for children and teenagers is the possibility of changing the trajectories of certain disorders that are beginning to appear,” explains the researcher. Often, the observations of child psychiatrists are summarised as intermediate symptoms, which may or may not lead to established psychiatric disorders (schizophrenia, depression, etc.). “Lastly, we see risk factors for depression rather than depression itself in young patients. And not all of them become depressed. What is interesting is

being able to identify the factors and targets on which we could act to avoid unfavourable developments,” adds Alexandra Rouquette.

Artificial intelligence to support child psychiatry

The earliest and broadest identification of risk factors for mental disorders is therefore at the heart of child psychiatry research. Within their research team, Éric Artiges and Jean-Luc Martinot, respectively psychiatrist and child psychiatrist at Inserm, have addressed anxiety disorders and the predictors of their appearance in adolescence. Using artificial intelligence methods such as machine learning, the two researchers from the Developmental Trajectories & Psychiatry Laboratory (Univ. Paris-Saclay, ENS Paris-Saclay, Inserm), located at the Borelli Centre (Univ. Paris-Saclay, CNRS, ENS Paris-Saclay, Univ. Paris Cité, SSA), monitored the mental health of more than 500 teenagers in order to identify and classify warning signs of the onset of anxiety disorders. “This artificial intelligence methodology is used to try and discover the warning signs that could characterise the individual risk of developing a disorder,” says Jean-Luc Martinot. “Our study shows that no single

symptom can guarantee the risk of a particular disease, as when they are all present, the set of signs announces a high risk.”

This work was made possible by the European cohort study IMAGEN, launched in 2008, which involves monitoring more than 2,000 teenagers using psychometric, neuropsychological and neuroimaging measures. *“This is the first interdisciplinary global cohort study to look at all the changes that occur during adolescence,”* says Jean-Luc Martinot. *“One of the most important results of the study is the illustration of brain development that is quite characteristic of teenagers, with gender and environmental differences,”* explains the researcher.

Psychometrics to challenge ancestral practices

At the heart of the vast majority of psychiatric studies, of children or adults, is a key element – the questionnaire, a potential source of numerous biases. Alexandra Rouquette is a specialist in psychometrics in the CESP Developmental Trajectories and Psychiatry team. *“It represents the study of the measure of any phenomenon perceived by the subjects, whether psychological or not. Methodology is central to my research,”* she explains.

One of the main areas of study for the researcher is determining the extent to which the characteristics of the person filling out the questionnaire on behalf of patients (a parent in child psychiatry studies, or a relative of a person in palliative care, for example) influence the elements measured in the patient. *“Today, I wonder if a depressed parent would fill out a questionnaire about their child differently if they weren’t depressed?”* Alexandra Rouquette is also questioning the limiting practices at the origin of these questionnaires. *“For example, when depression is measured using a ten-item questionnaire, the results of this questionnaire are expected to reflect the presence or absence of a linear ‘depression’ variable. That’s pretty basic. We have to question the links between these ten questions, these symptoms (overwork, fatigue, etc.), whether identified or not, whose appearance leads the individual into a vicious circle and favours the appearance of a characteristic depression. This methodology, network analysis, is common in sociology, is an alternative to traditional psychometrics and opens up an innovative way of understanding the development of psychiatric disorders,”* says the researcher.

Child psychiatry research, a discipline in dire need of resources

Recent advances in child psychiatric research now show that the brain is in full development

during adolescence. *“This age group includes several stages of physiological vulnerability, but also opportunities for adapted preventive interventions upstream of care,”* confirm Jean-Luc Martinot and Éric Artiges. However, due to a lack of funding, studies on the subject are rare: in France, there is only one Inserm team focusing on clinical and epidemiological developmental psychiatry. *“We are the only large-scale team,”* confirms Bruno Falissard. *“There is a lack of interdisciplinary research on children and adolescents, even though it is precisely through multidisciplinary (neurosciences, physiology, mathematics, epidemiology, etc.) that we can help to decompartmentalise research,”* notes Jean-Luc Martinot.

“There is a lack of interdisciplinary research on children and adolescents, even though it is precisely through multidisciplinary that we can help to decompartmentalise research.”

Jean-Luc Martinot

In correlation with this crisis of disciplinary research, child psychiatry also suffers from a lack of means. In a report published in March 2023, The Court of Auditors estimated that approximately 1.6 million children and teenagers suffer from a psychological disorder, while only half receive treatment. The report also stated that the number of child psychiatrists in France, which decreased by 34% between 2010 and 2022, is currently under 2,000. *“There is a societal recognition problem,”* says Bruno Falissard. *“There are a lot of preconceived notions about children’s disorders; we think that being young is great, that we never have problems at that age. There is a form of blindness. And that in a way, child psychiatrists are strange people wanting to give medicine to children. But no, there are children today who try to commit suicide,”* says the Director of CESP.

Publications

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Title

Portrait of eco-anxiety, the disorder that eats away at young people (too)

While not considered a disease, eco-anxiety due to climate inaction can be the root of a number of disorders. It has not been extensively studied in children and teenagers and does not require therapeutic treatment, but rather a broad social response.

Eco-anxiety, a contraction of ecology (the study of living beings and their interactions with each other and with their environment) and anxiety (a psychological disorder caused by the fear of danger), defines a range of emotions linked to the prospect of environmental loss, particularly due to climate change caused by human activities. These are the words of the American Psychological Association (APA), the American professional society of psychologists, which does not define eco-anxiety as an illness. Moreover, this disorder is not directly linked to climate change, explains Laelia Benoit, a researcher in the Developmental Psychiatry and Trajectories Laboratory of the Centre for Epidemiology and Population Health (CESP – Univ. Paris-Saclay, UVSQ, Inserm): “Eco-anxiety is caused by climate inaction rather than by climate change itself.”

Although this disorder is not specific to young people, it has very rarely been the focus of studies of children and teenagers. “The term *solastalgia* is often used as a synonym for eco-anxiety, but the root of the word does not include children,” says Laelia Benoit. “*Solastalgia* defines a feeling of nostalgia for an environment that we have known and that has changed over time. A typical example is remembering snowy winters when today it doesn’t snow anymore where we live. I find that this concept does not apply to children as they do not have the hindsight to account for the evolution of winters, although they are aware of climate change. Eco-anxiety is a more appropriate term, in my opinion.”

Laelia Benoit trained as a pedopsychiatrist and was initially interested in other disorders, namely school phobia. During her consultations, many children and teenagers express their concerns about climate inaction, although this is not the main reason for their

visit. “Eco-anxiety was somehow compounding their problems with school and their sense of inadequacy. Ultimately, these patients were consulting for different reasons (depression, harassment, etc.) and for psychiatric disorders, to which eco-anxiety was added. This is the reason I decided to undertake research on this topic,” she explains.

Further research on eco-anxiety in young people

Eco-anxiety is not a new subject and many publications have already confirmed the different impacts of climate change on mental health... in adults. The *Climate Change Anxiety Scale*, developed in the form of a questionnaire by Susan Clayton and Bryan Karazsia of the College of Wooster (USA) in 2020, is now used as a reference for measuring the degree of eco-anxiety. But it is not appropriate for younger children, as Laelia Benoit states: “The questions on the Scale do not apply to teenagers. For example, it says ‘I am so concerned about climate change that it is interfering with my work or family responsibilities.’ Young people don’t have jobs and don’t have to take care of their families, so they can’t answer that kind of question.” Another question for the researcher is the difference between the spectra of emotions found in adults and children. “In adults, the predominant emotions are guilt, sadness, shame and feeling responsible but not knowing what to do. Anger and injustice prevail in young people.”

“Eco-anxiety is a social problem that requires a social response.”

Laelia Benoit

To delve deeper into the initial observations she made during her consultations, Laelia Benoit is conducting several qualitative studies with young people from different countries. The results of a survey of more than 100 children from France, the United States and Brazil do not show the emergence of a “serious eco-anxiety epidemic”, although this does not reassure the researcher: “During the study, no child told us that their eco-anxiety was keeping them from living. It’s a concern, sure, but children generally manage to not let it overwhelm them. At first, this feedback was quite reassuring, but not totally so, as we know that ‘stress-vulnerability’ patterns are conducive to a number of stress-related diseases, such as cardiovascular diseases. In other words, an existing

stress, even a small one, spread over 30 years, increases the risk of certain health problems. Lastly, there are a number of questions regarding the development of these young people with moderate, permanent stress.”

Another of her studies focuses on ways to relieve eco-anxiety through action. “What children are telling us is, ‘we know what’s going on, now we want to do something about it.’ Eco-anxiety is a problem related to a social experience, so the answer will come from a social experience, in this case climate action. We have demonstrated with young adults that collective climate action is correlated with better mental health.” These collective actions, as studied by the researcher, relate to all the actions it is impossible to carry out alone, such as organising fairs or second-hand clothes sales and changing the practices of your business or co-owned property. “These collective actions are positive and motivating for two reasons. First, they allow young people to realise that they are not alone in their interest in the subject. Second, collective actions are bound to have more impact, as insulating an entire building is more effective than reducing the temperature of your radiators by one degree,” explains Laelia Benoit.

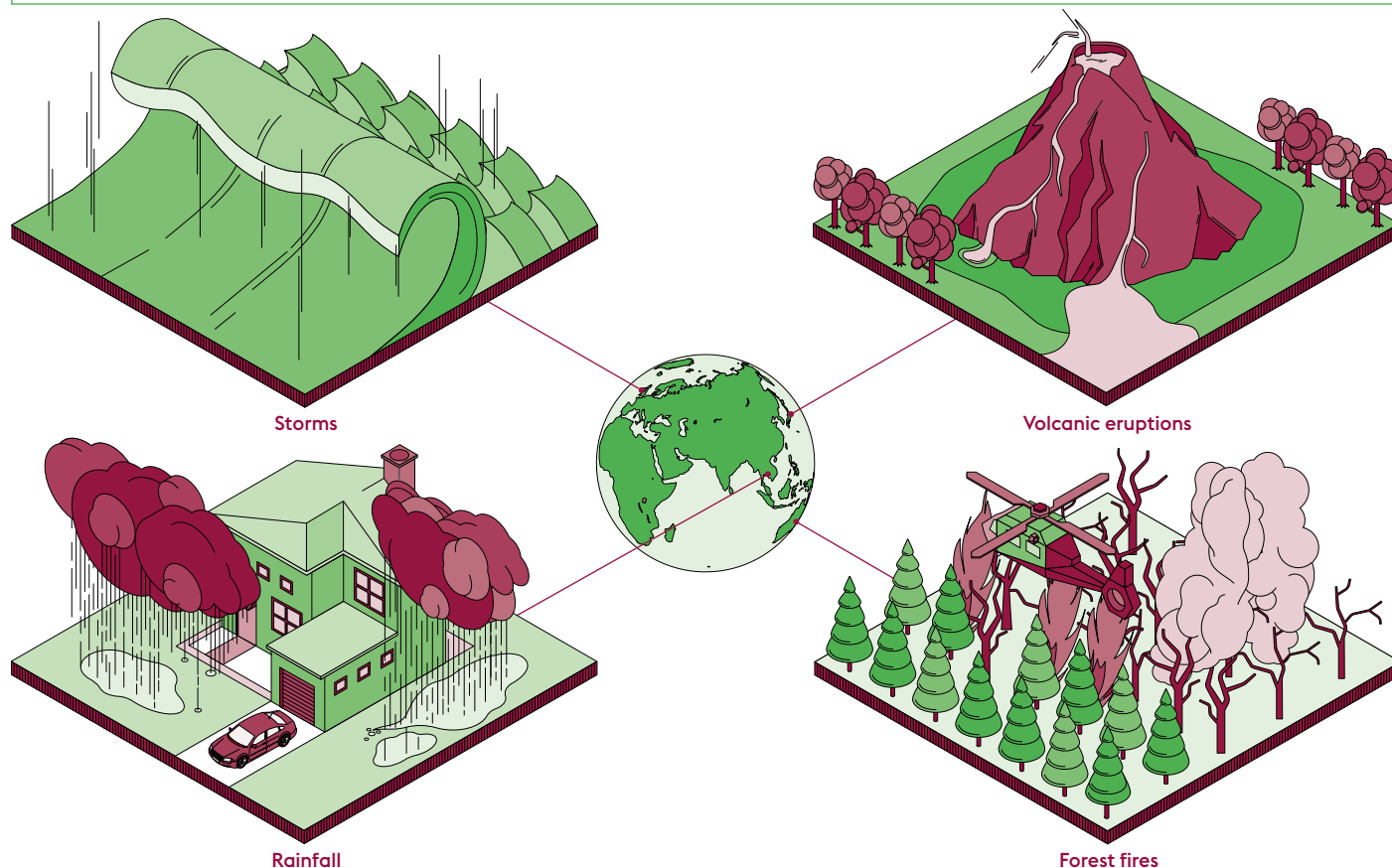
“Eco-anxiety is not a disease and there is no treatment. It is a social problem that requires a social response. We must alert and change our passive and indifferent society in the face of the serious issue of climate change,” concludes the researcher.

Publications

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Title

The dynamics of extreme weather events



With extreme weather events expected to become more common as a result of climate change, it is more important than ever to understand and predict their behaviour. To this end, scientists at Université Paris-Saclay are exploring the natural disasters and weather phenomena that occur around the globe, such as forest fires, volcanic eruptions, rainfall and storms. These fluid dynamics specialists have an unparalleled ability to scrutinise the movements of air and water.

Like fires, some of which have been extremely large during recent droughts, volcanic eruptions release huge plumes of smoke that spread through the air. As well as lava, an erupting volcano ejects materials and gases from the Earth's inner layers. While there are on average around 60 eruptions each year – some occasionally major – of the 1,500 active volcanoes on Earth, the number of drought-related fires is expected to increase with global warming. In addition to the consequences of such events on

local fauna, flora and infrastructure, and the risks they pose to populations, the plumes they release also affect the atmosphere and change the climate on a global scale. But in what ways?

Swirling plumes

Sergey Khaykin, researcher at the Atmospheres, Environments, Space Observations Laboratory (LATMOS – Univ. Paris-Saclay, UVSQ, CNRS, Sorbonne Univ.), is tracking the trajectories of the gas, ash and aerosol columns emitted during eruptions to find an answer to this question. “Plumes of smoke are rapidly dissolved in the troposphere, the layer of the atmosphere closest to the ground, as a result of turbulence created by the winds blowing through it. But in the case of a large fire or a very explosive eruption, the plume reaches the stratosphere, a much calmer layer more than 13 km above the ground,” notes the researcher. This plume can then remain cohesive for months. It is carried by the winds like a hot air balloon, and circles the globe several times.

While some plumes decline over time, others rotate and form cohesive vortices. “This phenomenon was highlighted during the bushfires in Australia in 2020,” explains the LATMOS researcher. “This vortex remained in the

stratosphere for more than three months and raised a huge confined bubble of smoke up to 35 km in altitude. Due to the magnitude of the disaster, the vortex was so huge that we could not miss it.” Four conditions must be met for this kind of whirlwind to be created: the plume must reach the stratosphere, have summer weather without strong winds, be warmer than the surrounding air, which drives its initial rotation, and, lastly, be far enough from the equator for the rotational movement to be accentuated by the Coriolis force, an inertial force resulting from the Earth's revolution on itself and more pronounced near the poles.

Volcanoes become involved

“Once a forest fire reaches a high altitude, it is powerful enough for the other conditions to be met,” says Sergey Khaykin. “However, we thought for a long time that volcano plumes could not display the same behaviour, due to their different composition.” While forest fires release carbonaceous aerosols that heat up under the action of the sun, volcanic plumes are largely composed of sulphate droplets, which absorb little solar radiation.

But recent observations are challenging this paradigm. “We are scrutinising the atmosphere

in great detail thanks to the new ground-based instruments and satellites commissioned by the European Space Agency (ESA). In 2019, during an eruption of the Russian volcano Raikoke on the Kuril Islands, we were surprised to observe a very dark plume that retained a consistent shape, gained altitude and rotated on itself. So volcanic eruptions are also capable of creating these long-term vortices if they release a lot of ash."

Analysing the global consequences

Understanding the dynamics of plumes is essential for predicting their effects. With a narrow vortex, these effects are local and strong: *"The giant fires of 2020 weakened the ozone layer and overexposed Australia to UV radiation,"* says Sergey Khaykin. Conversely, a diffuse plume tends to have global consequences, such as those caused by the eruption of the underwater volcano Hunga Tonga in January 2022. Located near the Fiji Islands, in the middle of the South Pacific Ocean, this volcano in the Tonga archipelago became the scene of an extremely explosive eruption. The released plume reached a record altitude of 58 km and covered almost the entire globe as it was breaking up. However, no vortex was created as the volcano was too close to the equator and the smoke contained very little ash.

While large volcanic eruptions generally decrease the Earth's overall temperature by blocking the sun's rays before they reach the ground, the effect of the Hunga Tonga volcano was quite different. *"The seawater vaporised by this underwater eruption increased the concentration of water vapour in the stratosphere by 13%. It was like diverting the course of the Amazon River for ten minutes."* Since water vapour is a greenhouse gas, this extra vapour released into the atmosphere will warm the global climate for at least the next five years before dissipating.

A stormy Irish coast

By chance, while the pressure waves generated by the eruption of the Hunga Tonga volcano were travelling around the world, they were accidentally captured by the research station of the Centre Borelli (Univ. Paris-Saclay, CNRS, ENS Paris-Saclay, Univ. Paris Cité, SSA) on the island of Inis Meáin, off the west coast of Ireland. After capturing this signal, Frédéric Dias's team shared this curiosity with local school children, *"who realised that what happens on the other side of the world can affect them. A parallel with climate change was quickly established,"* says the Centre Borelli's mathematician.

This observation station was built by Frédéric Dias's team over the last three years and aims

to examine another natural phenomenon and its dynamics, namely the breaking of waves. This isolated location, on an island of the Aran archipelago four kilometres long and with a population of around 100, was not selected by chance. *"We chose to immerse ourselves in the most extreme conditions, as the west coast of Ireland receives the full force of all the storms that arrive from the Atlantic Ocean. It is perhaps the place in Europe where the waves are the strongest,"* says Frederic Dias.

Wave breaking

Among other work, his team is leading the HIGHWAVE project, launched in 2019 and funded by an ERC Advanced Grant from the European Research Council. One of its objectives is to improve wave height forecasts in the open ocean. This wave "weather report" is useful for container ships and ferries, which risk sinking in excessive waves. At the moment, predictions remain inaccurate. *"We are years behind in atmospheric meteorology,"* says Frédéric Dias.

To improve it, we need to take wave breaking into account in physical models. When a wave becomes too high under the action of the wind, it breaks and creates turbulence, which can be seen in the formation of foam. *"While a wave breaks, the system is no longer linear and it becomes extremely difficult to understand its behaviour,"* comments Frédéric Dias. However, it is on this task that his team members have started to work, using the various instruments installed in the station. *"We brought a seismometer to measure the vibrations caused by waves crashing against the cliffs, a weather station to monitor wind patterns, a high-resolution radar, and sensor-equipped buoys with GPS and accelerometers."* All the equipment is holding up well despite the hostile environment.

The crashing of the waves against the rocks

Before the HIGHWAVE project began, researchers noticed the sheer force of the waves on the island. This is evidenced by the hundreds of tons of stone blocks displaced during winter storms. The team is trying to reproduce these phenomena in the laboratory. *"To understand the action and force of the waves, we have previously carried out experiments on a reduced scale,"* says Frédéric Dias. The protocol includes a wave generator hitting 8 kg smart blocks filled with sensors, and a high-speed camera. *"The pressure is the greatest when the crest and trough of the wave hit the block in the same place."* The key to achieving maximum block displacement is therefore a combination of high pressure and lengthy impact time.

The team is now working on transposing this experiment to the Irish coastal setting. *"We instrumented half a dozen one-ton blocks with pressure and acceleration sensors, then observed their movements continuously over several months,"* says Frédéric Dias. These observations, which are still underway, will later be combined with numerical computation to model the displacement of the blocks. The HIGHWAVE project research will be developed thanks to an ERC Proof of Concept grant recently received by the researcher for his REALTIMESEA or Real-time measurements of oceanic waves using connected buoys and mobile stations project. The scientists are delighted with the quality of the data already collected and want to continue the station so it can host teams of scientists from all over the world.

Drip erosion

While the power of a raging sea is nothing like the impact of a drop of water, when on the scale of torrential rain, the water also has destructive potential. Researcher Claude Mügler, from the Laboratory for Sciences of Climate and Environment (LSCE – Univ. Paris-Saclay, CNRS, CEA, UVSQ), is interested in the consequences of monsoon rainfall on a watershed in northern Laos, a tropical mountainous region undergoing rapid change. The vegetation on the ground is becoming increasingly scarce as the food crops are being replaced by teak plantations, which are much more lucrative as the teak is then exported. During the rainy season, however, the water intercepted by the very large teak leaves forms huge drops which erode the soil as they fall and prevent the growth of vegetation under the trees. *"Soil leaching has become a major concern because it increases erosion and spreads faecal bacteria from livestock manure into the environment,"* says Claude Mügler.

On the station, scientists from the French National Research Institute for sustainable Development (IRD), with whom the LSCE researcher collaborates, have set up an experimental mechanism for understanding how raindrops interact with bare soil. On a sloping hillside, artificial rain, whose flow and power are controlled, waters small plots of bare soil measuring one square metre each. A clever process imitates the mechanical action of grass and low vegetation. *"Half of each plot is covered with a mosquito net. It is placed a few centimetres above the ground and allows water to pass through, but it breaks the kinetic energy of the water drops, just as plant cover would do,"* Claude Mügler explains. There is a real difference between the two half-plots of land. *"Without a mosquito net, muddy crusts form under*



the impact of the raindrops. The environment quickly becomes impermeable. This is the 'splash' effect, which amplifies runoff, erosion and the leaching of soil bacteria."

Finding the equation to describe the runoff

Using data collected in the field by her IRD colleagues, the researcher models the amount of water runoff and the movement of *E. coli* bacteria contaminating nearby drinking water sources. She constructs equations for flow and transport, with each term corresponding to a physical process, such as the capacity of the soil to allow water to infiltrate. She also takes into account the evolution of soil properties as a function of the time and the thickness of the water runoff.

Finding the right equation to describe the behaviour of the water and the correct values of the parameters requires trial and error. The numerical tools used test a multitude of combinations and only retain those whose results best simulate the field experiments. "I used the Cast3M code, a toolkit that allows us to build small equation blocks and combine them like LEGO® bricks. The parameters are then calibrated, but an expert eye is always needed to ensure the validity of the results," says the researcher. This multidisciplinary work provides a new understanding of the damage caused by raindrops on bare soil and their health consequences.

All this research sheds new light on the extreme events associated with climate change, and on the deterioration of natural environments and their effects on populations. Like so many new warnings.

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Title

Putting fluids into an equation

Fluid dynamics is not just a question of applied science. The equations involved are also fascinating for fundamental mathematics.

While physics focuses on the world around us and describes it through equations, fundamental mathematics has a higher level of abstraction. "I don't study phenomena. For mathematicians, the basic material is the equation," clarifies Thomas Alazard, from the Centre Borelli (Univ. Paris-Saclay, CNRS, ENS Paris-Saclay, Univ. Paris Cité, SSA).

Mathematicians are interested in free boundary problems, which describe phenomena that change shape over time, such as the surface of the sea swollen by waves. "It just so happens that the equations I study come from fluid dynamics. They were developed by physicists and then taken up by mathematicians who found their properties interesting."

The rolling of the waves and the movement of the cells

The researcher cites as an example Darcy's law, introduced by hydraulic engineer Henry Darcy in the book *The Public Fountains of the City of Dijon*, published in 1856, in which he presented his struggle to supply the city with running water. Darcy's law governs how the velocity field of a fluid evolves in a porous medium like sand. "From this law, it is possible to deduce the Hele-Shaw equation, which is used in many fields, for example to study oil extraction or cell motility. A long line of mathematicians has studied this question. It is one of the parabolic equations, with interesting properties."

"I have also worked on dispersive equations, such as that describing the behaviour of waves. You have to imagine that when a storm breaks in the middle of the ocean, it appears chaotic. The waves spread in all directions and their frequencies are very varied. Yet, when they reach the shore, they have that regular appearance that makes a lasting impression." In the early 19th century, mathematician and physicist Joseph Fourier understood that any complex signal can be broken down into an infinite sum of simple form components called harmonics. However, these harmonics travel at different speeds. His contemporary Augustin Louis

Cauchy used this work to deduce that at a given moment, only some of these harmonics reach the shore, forming regular waves.

The mathematical path

The classical mathematics developed two centuries ago makes it possible to calculate the solutions of equations with constant coefficients. In fluid dynamics, however, it is necessary to work with non-linear equations with variable coefficients. This is the complexity of the discipline and what fascinates researchers in mathematics. "My job is to transform equations into simpler ones. The difficulty lies in the transformation. To reduce the number of variables, I use what is known as a paradiifferential analysis method. Ideally, we obtain an equation in a simplified form that can be solved explicitly."

Although purely fundamental, Thomas Alazard's field of study nonetheless addresses themes related to the understanding of the world. "Fluid dynamics equations pose central and relevant questions. They have given rise to great ideas over the last two centuries and will continue to be studied for a long time to come," the mathematician predicts.

Publication • Alazard, T., et al. Lyapunov functions, Identities and the Cauchy problem for the Hele-Shaw equation. *Commun. Math. Phys.* 2, 377 (2020).

Title

France 2030: Université Paris-Saclay fully integrated into priority research programmes and equipment (PEPR)



Priority research programmes and equipment (PEPR) are part of the government's "France 2030" investment plan, which aims to develop industrial competitiveness and future technologies and build or consolidate French scientific and technological leadership. PEPR finance upstream research and development (R&D) activities (levels 1 to 4 on the Technology Readiness Level or TRL scale) conducted in scientific fields considered to be priorities at a national or European level. These fields are those linked to – or likely to lead to – a major technological, economic, societal, health or environmental transformation. Involved in a significant number of them, Université Paris-Saclay co-pilots the exploratory PEPR, eNSEMBLE.

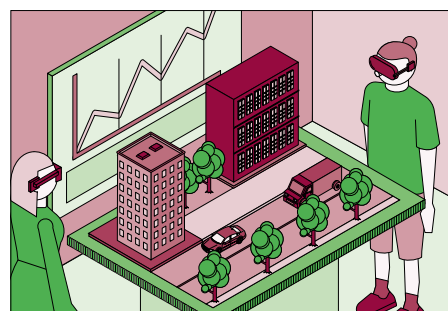
Launched in the second half of 2021 in successive waves, PEPR are operated by the French National Research Agency (ANR) and each one mobilises a large scientific community specialising in the field along with numerous partners. Each PEPR has one or more scientific pilots (national research organisations, universities, etc.) appointed by the French government. These pilots develop an effective and coherent scientific and technological strategy and coordinate the efforts of the scientific community to achieve the programme's objectives.

There are two types of PEPR: PEPR linked to national acceleration strategies and exploratory PEPR. The former accompany a

transformation that is already underway, with an established market, products, services, uses and clearly identified stakeholders. Such PEPR are intended to support the acceleration of the transformation by establishing a comprehensive and coordinated national strategy and help remove scientific barriers or obstacles. Exploratory PEPR prepare for the emergence of new strategies. They accompany a transformation that is still in its infancy or early stages, without a market. They support the exploration of the strategy's potential and its possible impact. Each PEPR gives rise to the financing of targeted projects, already mature when the PEPR is outlined, or projects selected later through calls for projects or expressions of interest.

At this time, 25 national acceleration strategy PEPR and 18 exploratory PEPR have been launched, for up to eight years. These PEPR are at very different stages of progress: some have established work programmes, with known stakeholders, while others are still developing a roadmap, without an exact identification of the stakeholders.

eNSEMBLE: developing the future of digital collaboration



The eNSEMBLE exploratory PEPR, co-piloted by Université Paris-Saclay, Université Grenoble Alpes, the National Institute for Research in Digital Science and Technology (Inria) and the French National Centre for Scientific Research (CNRS), aims to design the collaborative digital tools of the future.

From email to video conferencing, document sharing and social networking, digital collaboration is now an integral part of both the professional and private spheres. This dependency on collaborative tools for work, education and entertainment, exacerbated during the COVID-19 pandemic, is unlikely to weaken, as the physical and digital worlds are now intertwined. While current digital collaboration tools seem to cover users' needs, the capabilities and level of openness and integration of such tools are in fact very limited. "Most of the applications we use to collaborate lock us into 'walled gardens', that don't communicate with each other and force us to store our data in information silos that we don't control. This creates monopolies and stifles innovation," says Michel Beaudouin-Lafon, co-director of eNSEMBLE. Whether it is to reduce travel in response to the environmental crisis, create a better network across a region or deal with the transformations of the coming decades, digital collaborations will become increasingly omnipresent and take place on ever greater scales, requiring more fluidity.



The eNSEMBLE exploratory PEPR aims to reinvent digital collaboration tools. In order to do so, a paradigm shift is required: collaboration and sharing must be native features of digital systems, in the same way as files, applications or copy and paste. It is about inventing shared digital spaces that do not limit themselves to replicating the physical world in virtual environments and giving communities the opportunity to organise their spaces as they see fit.

Research areas will focus on the design of innovative collaborative environments and conceptual models; the combination of human and artificial intelligence in collaborative configurations; the development of fluid collaborative experiences that promote interoperability; the creation of healthy and sustainable communities; and the specification of socio-technical standards including legal and regulatory frameworks.

The work will be multidisciplinary (computer science, ergonomics, cognitive psychology, sociology, design, law, economics) and of a theoretical and empirical nature. By improving productivity, learning, care and well-being and participatory democracy, this will influence many sectors of society: education, health, industry, science, services, public life, leisure, etc.

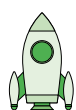
Several units of Université Paris-Saclay are involved, such as the Interdisciplinary Laboratory of Digital Sciences (LISN – Univ. Paris-Saclay, CNRS, CentraleSupélec, Inria) and its platforms EVE-Room, EVE-XR, WILD and WILDER, the Computer Science, Bioinformatics, Complex Systems Laboratory (IBISC – Univ. Paris-Saclay, Univ. d'Évry), the Complexity, Innovation, Motor and Sport Activities Laboratory (CIAMS – Univ. Paris-Saclay, Univ. d'Orléans), the Innovation, Technologies, Economics and Management Laboratory (LITEM – Univ. Paris-Saclay, Univ. d'Évry, IMT-BS) and the Business Law and New Technologies Laboratory (DANTE – Univ. Paris-Saclay, UVSQ).

25 national acceleration strategy PEPR and 18 exploratory PEPR launched to date and which meet the eight societal challenges of Université Paris-Saclay:

In italics: PEPR in which Université Paris-Saclay is an institutional partner or in which the

University's laboratories are already involved

◦ national acceleration strategy PEPR
● exploratory PEPR



Aeronautics and space

- Batteries
- *Origins (Origins, from planets to life)*

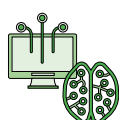


Biodiversity, agriculture and food

- AE&N (Agroecology and digital technology)
- BRIDGES (Link conservation, development and cooperation objectives to increase resilience to climate change, food insecurity and

emerging conflicts in the Southwest Indian Ocean)

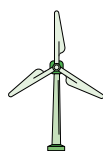
- Deep ocean floor
- FORESTT (Forests and global changes; socio-ecological systems in transition)
- SOLU-BIOD (Biodiversity and nature-based solutions)
- SVA (Advanced plant breeding in the face of the climate challenge and the agro-ecological transition)



Digital transformation and artificial intelligence:

- 5G and future telecom network technologies
- Artificial intelligence

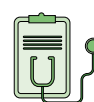
- Cloud
- Cybersecurity
- eNSEMBLE (Future of digital collaboration)
- MolecuArXiv (Storage of big data on DNA and artificial polymers)
- NumPEX (High performance digital for exascale)
- SPIN (Spintronic innovations for a frugal, agile and sustainable digital world)



Energy, climate, environment, sustainable development

- AE&N (Agroecology and digital technology)
- B-BEST (Biomass, biotechnologies and sustainable environmental technologies for chemicals and fuels)
- FairCarboN (Carbon in continental ecosystems; levers and trajectories for carbon neutrality)

- H₂ (Carbon-free hydrogen)
- OneWater (Water as a common good)
- Recyclability, recycling and reincorporation of recycled materials
- Solutions for the sustainable city and territorial innovations
- SOUS-Sol (Subsoil, a common good)
- SVA (Advanced plant breeding in the face of the climate challenge and the agro-ecological transition)
- TASE (Advanced energy systems technologies)
- TRACCS (Transform climate modelling for climate services)



Health and well-being

- Biotherapies and bioproduction of innovative therapies
- EID (Emerging infectious diseases)

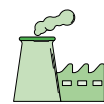
- Prezode (Prevent the emergence of zoonotic diseases)
- PROPSY (Precision psychiatry draft project)
- SAMS (Food systems, microbiome and health)
- SanteNum (Digital health)
- Women's health, couples' health



Increasing and sharing knowledge

- ATLASea (Atlas of marine genomes; from big data to innovation)

- Deep ocean floor
- EnsNum (Education and digital)
- IRIaMa (Integrated risk management for more resilient societies in an era of global change)
- LUMA (Enhance light-matter interactions)



Industrial renewal

- Cultural and creative industries
- Cybersecurity

- DIADEME (Integrated devices for accelerating the deployment of emerging materials)
- Electronics
- O₂R (Organic robotics)
- Quantum technologies
- SPLEEN (Industry decarbonisation)



Transport and mobility

- Batteries
- B-BEST (Biomass, biotechnologies

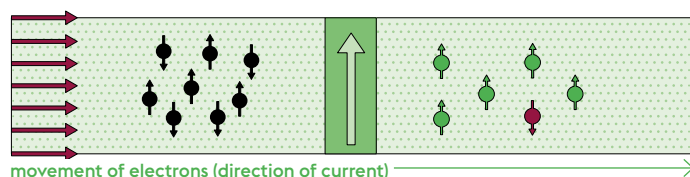
- and sustainable environmental technologies for chemicals and fuels)
- Digitalisation and decarbonisation of mobility
- H₂ (Carbon-free hydrogen)

More information on PEPR:
<https://anr.fr/en/france-2030/programmes-et-equipements-prioritaires-de-recherche/>

Title

Spintronics and its developments: material interfaces in the spotlight

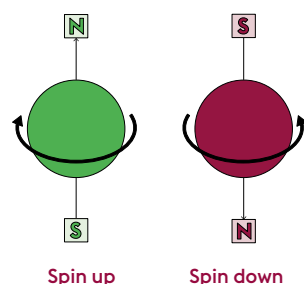
PRINCIPLE OF SPINTRONICS



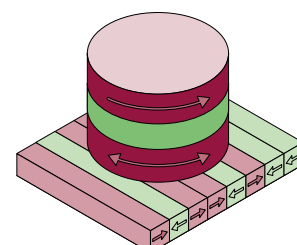
→ Current of electrons from both spin directions

○ Conductive non-magnetic material

● Magnetic thin film



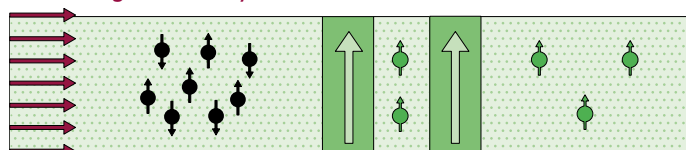
APPLICATION OF THE MAGNETIC TUNNEL JUNCTION



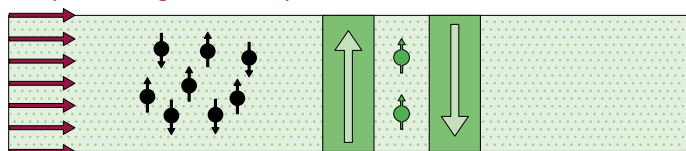
Reading head

PRINCIPLE OF THE GIANT MAGNETORESISTANCE

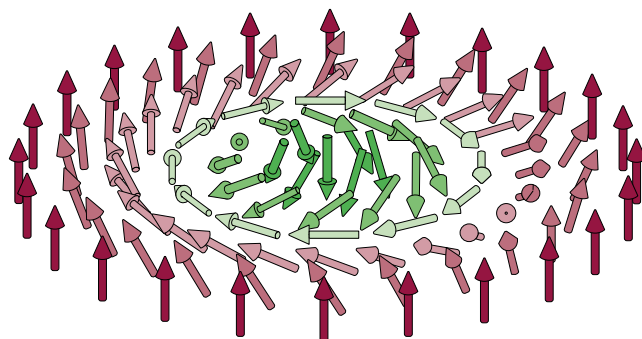
Parallel magnetisation layers



Anti-parallel magnetisation layers



EXAMPLE OF MAGNETIC SKYRMION AT THE INTERFACE OF MATERIALS



For some time, new themes have been emerging in spintronics, exploring the original effects in nanometric heterostructures of involved materials and at their interfaces. They are studying its potential for the development of new spintronic devices that are not only even more efficient, but also and above all consume very little energy.

Magnonics, oxytronics, orbitronics... While the discovery of giant magnetoresistance by French physicists Albert Fert and German Peter Grünberg – awarded the Nobel Prize for Physics in 2007 – marked the birth of spintronics in 1988, today, this science combining electronics and magnetism is booming. Based on exploiting the spin of electrons – one of the elementary building blocks of atoms – since the late 1990s it has been the origin of the revolution in the information storage capacities of hard disks and the development of technologies involving the fine detection of magnetic current fields.

Today, the digital sector, whose technologies are mainly based on conventional electronics,

accounts for 10% to 12% of global electricity consumption. With the explosion of cloud computing and data centres, this figure will possibly reach 20% - 30% by 2030. An environmental cost incompatible with global warming and the need for energy sobriety. Consequently, a paradigm shift is required: alternative, more energy efficient solutions for processing and storing information must be proposed. One of them is to use spintronic components, which are intrinsically much more energy-efficient.

At Université Paris-Saclay, several laboratories are involved in research that could lead to virtuous innovations. This is for example the case of the Joint Physics Unit CNRS/Thales (UMPhy – Univ. Paris-Saclay, CNRS, Thales), the Centre for Nanoscience and Nanotechnology (C2N – Univ. Paris-Saclay, National Centre for Scientific Research or CNRS, Univ. Paris Cité), the Condensed State Physics Service (SPEC - Univ. Paris-Saclay, CNRS, Alternative Energies and Atomic Energy Commission or CEA) and the Solid State Physics Laboratory (LPS – Univ. Paris-Saclay, CNRS). These teams, along with others, are working towards a better understanding of the physical effects operating in various materials and/or spintronics

nanostructures, and are contributing to new cycles of innovations, as part of the SPIN priority research programme (*see focus hereafter*).

From a charge current to a spin current

Spintronics is a recent research field that manipulates spin currents. Unlike conventional electronics, which relies solely on the electron's negative electric charge and the manipulation of charge currents to process information, it relies additionally on one of the electron's intrinsic properties, its spin (or magnetic moment), where only two orientations are possible: upwards (spin up) or downwards (spin down).

It started with the discovery of the giant magnetoresistance effect and the progress of ultra-thin film deposition techniques (a few nanometres thick). The basic concept is to place different layers of materials (alternating magnetic and non-magnetic materials) successively on the path of the electrons of a current, and to modify their electric resistance by applying a magnetic field, which changes the relative magnetisation of the magnetic layers. Ferromagnetic metals (iron, nickel, cobalt), which have an intrinsic magnetism,

are used for this. The mobility of the electrons in the current flowing through such a layer depends on the orientation of the spins with respect to the magnetisation of the layer. It is greater if the spins are aligned (parallel orientation) rather than opposed (antiparallel orientation); the electrical resistance is low and high respectively. The resistance of a multilayer is then more or less important (or weak) according to the relative orientation of the magnetisation of the layers.

Magnetic tunnel junctions, in which an insulating layer separates two ferromagnetic layers of opposite orientation, are a flagship device developed on the same principle. They have been at the heart of hard disks for twenty years and are now essential elements of magnetic random access memories (MRAM), in which the information is coded and stored in binary form (0 or 1), depending on the alignment (parallel or antiparallel) of the magnetisations.

Couplings and memories

Another spintronic effect has been added to this landscape around the year 2000: spin-transfer torque (STT). With it, a spin-polarised electric current (or ideally a pure spin current), if large enough, is able to force the reversal of the magnetisation of the magnetic layer crossed.

Scientists are now evaluating the potential of other types of heterostructures, also involving ferroelectric or even multiferroic (ferromagnetic, ferroelectric and ferroelastic) materials. New effects are emerging, such as spin-orbit torque (SOT). This comes from the relativistic interaction between the magnetisation associated with the spin of the electron and the orbital motion of the electron. The interaction deviates the electrons from their trajectory in opposite directions for opposite spins. This provides for more efficient charge-to-spin current conversions. This effect is of particular interest when creating a new type of memory (SOT-MRAM).

It is also at the heart of a project involving UMPhy and the industrial company Intel which aims to develop a new type of transistor, the MESO (Magnetoelectric Spin-Orbit Transistor). *“The idea is to store information in a heterostructure where the input signal directs the polarisation of a multiferroic or magnetoelectric element coupled to a ferromagnetic element, to ‘write’ the magnetisation of the ferromagnetic element, and then ‘read’ this magnetisation by converting the spin current into a charge current,”* explains Albert Fert, now Emeritus Professor at UMPhy. *“The project with Intel aims for extremely low consumption levels, in the attojoule (10^{-18} joule) range.”*

Interfaces show their potential

The surface of nanomaterials placed in heterostructures and their interfaces are also areas being studied. Particular relativistic interactions (Dzyaloshinskii-Moriya interaction or DMI, Rashba interfaces, etc.) generate original electronic and topological states. Some metal two-dimensional (2D) electron gases are therefore fascinating objects. They are created at the interface of insulating oxides such as strontium titanate (SrTiO_3) or potassium tantalate (KTaO_3). *“These gases are very interesting because they have a very high mobility,”* says Agnès Barthélémy, from the Oxytronics team at UMPhy. *“When lanthanum aluminate (LaAlO_3) is deposited on SrTiO_3 , a charge discontinuity is created at the interface, because the atomic planes of TiO_2 and SrO are neutral and those of LaAlO_3 are charged. If the LaAlO_3 layers are further increased, a potential divergence is caused called polar catastrophe. To avoid this, a transfer of charges is made from the surface of the material to the interface, which creates a 2D electron gas. Another way to create the gas is to deoxidise SrTiO_3 by sputtering a material such as aluminium at room temperature. The aluminium will pump oxygen from SrTiO_3 , reduce it and produce electron-donating oxygen vacancies.”*

Magnetic textures, such as magnetic skyrmions are other objects that have recently been discovered. Long predicted, they were only observed for the first time about ten years ago. In these objects, the magnetic moments wrap around themselves in an arrangement topology stabilised by the DMI. This interaction requires two ingredients: symmetry breaking and spin-orbit coupling. *“In spintronics, it is quite common to have fairly heavy materials, such as platinum or palladium, in which the spin-orbit coupling is strong. When we make stacks with layers of heavy materials in contact with thin magnetic layers, we obtain very strong DMI amplitudes at the interface, even promoting local rotations of the magnetic moments and generating a state that is energetically favourable to the appearance of skyrmions,”* explains Vincent Cros of UMPhy.

These magnetic textures have a set of remarkable intrinsic properties. *“They are often topologically non-trivial, stable and resistant to external perturbations. They are also very small in size: from a few nanometres to a few tens of nanometres. They also have electronic transport properties. With the help of spin currents, we can move them, guide them and make them interact,”* comments Vincent Cros. This makes them interesting as a potential information carrier for new devices (memories, logic devices or even neuromorphic devices).

From domain walls to spin waves

Within the Novel Magnetic Devices (NOMADE) group at C2N, Thibaut Devolder and Joo-Von Kim’s research has long focused on domain walls, another magnetisation configuration in which to store information. *“When you want to develop a memory, such as the now industrially mature STT-MRAMs, you need to understand beforehand how the wall moves, thus the magnetisation dynamics of the nanostructure, so that the switching time can be reproduced. However, when such an object moves, it is necessarily subject to friction, which opposes the movement. This friction can be deterministic (fluid, viscous) or involve the passage of obstacles,”* comments Thibaut Devolder.

Recently, his team has been interested in the physics of spin waves and the means to generate, detect and manipulate these waves in nanostructured ferromagnetic metals. *“These are magnetisation waves that propagate in time and space.”* They have very original characteristics: *“They are anisotropic (they display different properties depending on their direction of propagation), frequency-adjustable (their phase and frequency can be manipulated with an external stimulus), and non-linear (they easily interact with each other).”* *“This physical richness opens up new prospects for applications, especially in low-power embedded electronics. We expect applications in communication technologies, neuroinspired tasks, analogue calculation, pattern or voice recognition,”* adds Joo-Von Kim.

As you can see, spintronics is booming. Moreover, as Albert Fert says with a smile in conclusion: *“Each new direction explored opens up new ones. Science is always moving forward!”*

Publications

- Luis M. Vicente-Arche et al. Metal/ SrTiO_3 two-dimensional electron gases for spin-to-charge conversion. *Phys. Rev. Materials* 5, 064005 (2021).
- Grelier, M. et al. Three-dimensional skyrmionic cocoons in magnetic multilayers. *Nat Commun* 13, 6843 (2022).
- A. Mouhoub et al. Exchange energies in $\text{CoFeB}/\text{Ru}/\text{CoFeB}$ synthetic antiferromagnets. *Phys. Rev. Materials* 7, 044404 (2023).



Title

SPIN PEPR: towards a virtuous cycle of spintronic innovations

With a budget of just over 38 million euros over eight years, the SPIN Priority Research Programme and Equipment (PEPR) aims to promote a new cycle of innovation in spintronics, considering frugality as an essential criterion and equal to the computing power, speed, miniaturisation or cost of devices. As part of the “France 2030” investment plan, it involves more than forty laboratories in France.

“We have chosen subjects which, for us, define the important future focuses of spintronics and on which French teams are already working and at the forefront of research,” explains Vincent Cros, CNRS co-director of the PEPR SPIN with Lucian Prejbeanu from CEA. “The first three targeted projects concern topological textures, ultra-fast or terahertz spintronics, and the dynamics of spin waves and magnonic effects. For these themes, the TRL (Technology Readiness Level) is relatively low (1 to 3). The other two targeted projects, which are a little more mature (TRL4), relate to spin transfer oscillators, for which there are still some obstacles to be removed, and spintronic sensors, one of the first flagship applications of spintronics, where we want to offer new-generation sensors with new functionalities and better properties.” The cross-functional platform projects target families of materials on which to conduct new research on spintronics, the tools for characterising their properties, and the theory-simulation, the objective of which is to structure the community. Two open calls for proposals, the first of which will be launched by late 2023/early 2024, will be used to complete the themes covered and set up interdisciplinary studies.

The targeted projects are exploratory, which is the very definition of this PEPR: *“The choice was made to allocate significant resources to emerging but promising scientific themes so that these projects could then become part of the national strategy and be included in the acceleration PEPR.”* There is already a very close link with the Electronics acceleration PEPR, *“in which research in spintronics is integrated in order to develop new generations of spintronic memory.”*

Title

Capturing the minute magnetic signature

The new generation of spintronic sensors, integrating innovative concepts and/or architectures, promise to be more agile, sensitive and robust, and lower the detection threshold of magnetic signals.

If there is one sector that has benefited from the development of spintronics, it is that of magnetic field sensors. *“When spintronics started to arrive on the application bench, it all happened very quickly and today, many things are already being marketed. In the automotive sector, for example, spintronic technologies, which are more sensitive, easy to integrate and consume less energy, have supplanted other previously-used technologies,”* notes Myriam Pannetier-Lecoeur, of the Nanomagnetism and Oxides Laboratory (LNO) of the Condensed State Physics Service (SPEC – Univ. Paris-Saclay, CNRS, CEA). *“There are sensors for speed, position, angles, current, etc.”*

Scientists are now looking at new features and adaptability. To do so, they rely on spin-transfer torque effects and magnetic textures, the potential of which is still to be fully explored. *“We are trying to develop more dynamic and sensitive sensors, with sensitivity in all three dimensions of the space. We also want to make their properties changeable on demand under electrical control, if the environment and the magnetic field range change.”*

Reducing sensor noise is another focus of research efforts. *“A sensor always has a basic noise, related to the thermal agitation of electrons and related to the electrical resistance of the material. At low frequencies, a noise in 1/f is added, corresponding to fluctuations in different energy levels. To reduce it, either the magnetic effects must be stabilised or the volume of the device increased.”*

Research at the interface with other sciences

Some of the group’s work concerns the detection of the magnetic signature of currents (neural, cardiac) in a body. *“Very small and local, they create magnetic fields with a value several orders of magnitude below that of the Earth’s field (40 μ T). To detect them, we need to increase the sensitivity of the sensors and decrease the noise.”* Recently, the

team has developed a sensor placed at the tip of a 25 μ m probe to measure in vivo the signature of neurons in the hippocampus of rats. *“A standard electrode records the electrical signal, which displays spikes in neuron activity. In parallel, the magnetic signal is recorded with the probe. Several one-hour sequences are carried out. After sorting and associating the electrical signals to the neurons near the probe, we match the magnetic acquisitions and average the events (several thousand!) to extract the magnetic signature of these neurons from the noise, in the order of nT,”* explains Myriam Pannetier-Lecoeur. *“With sensors that are ten times more sensitive, we would have a hundred times fewer events to average. This would save time and allow us to go further!”*

Other work targets magnetic imaging, including the development of a magnetic microscope capable of observing magnetised objects. *“We are also rolling out a low-field MRI project to be installed around the incubators of premature babies in hospitals. For these intermediate frequency (10 mT) signals, the coils of traditional MRI are less sensitive.”* A striking fact: all these projects share a common denominator, dear to the team: to go as far as implementing the technology developed in real-life situations.

Publication • Chloé Chopin et al. Magnetoresistive Sensor in Two-Dimension on a 25 μ m Thick Silicon Substrate for In Vivo Neuronal Measurements. ACS Sens. 2020, 5, 11, 3493–3500.

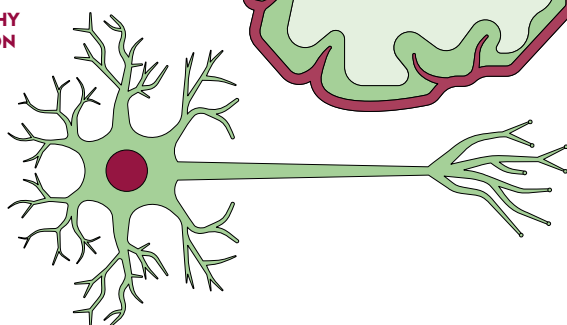
Title

Alzheimer's disease: mysteries and new leads

HEALTHY BRAIN

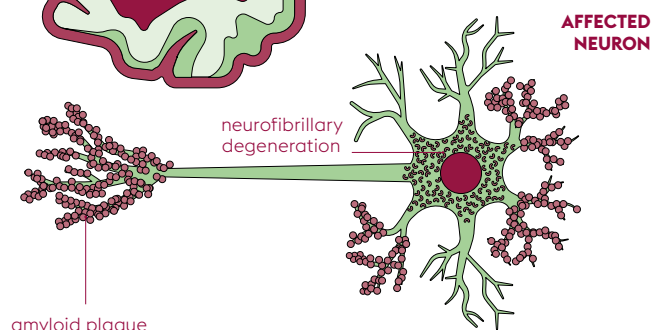
- 1 – Cerebral cortex
 - parietal: control of space, control of gestures
 - temporal: language and memory
 - frontal: executive functions
- 2 – Limbic system: emotions, links between memories and behaviour
- 3 – Hippocampus: memory processes

HEALTHY NEURON



BRAIN AND NEURON AFFECTED BY ALZHEIMER'S DISEASE

- 4 – The cortex shrivels up
- 5 – Ventricles fill with cerebrospinal fluid
- 6 – Shrinkage of the hippocampus



Alzheimer's disease is a neurodegenerative pathology that affects almost one million French people today, according to the Paris Brain Institute (ICM). The disease, whose most significant risk factor is age, is the leading cause of dementia worldwide, according to the World Health Organization (WHO). Development, diagnosis and treatment: scientists at Université Paris-Saclay are studying every possible research angle concerning the disease.

Today, WHO figures show almost 36 million people with Alzheimer's disease, a figure that could potentially triple by 2050. According to a study by Inserm and the University of Bordeaux, two million people in France will be affected by 2040, more than double the current number. *"It is a disease with a very high prevalence and incidence rate,"* says Yvette Akwa, researcher at the Diseases and Hormones of the Nervous System Laboratory (DHNS – Univ. Paris-Saclay, Inserm). *"The main risk factor for Alzheimer's disease is age. As we are living longer, the number of cases will increase in future years,"*

says the researcher. *"However, age is not the only risk factor, as women are more affected (60% of French patients are women, according to Inserm) due to the drop in oestrogen during menopause. Heredity, high cholesterol and environmental agents (smoking, alcohol consumption, depression, etc.) are the other notable risk factors."*

What do we know about Alzheimer's disease?

Discovered by German psychiatrist Alois Alzheimer in 1907, the disease that now bears his name is defined by two types of lesions affecting the brain, each caused by a specific protein: amyloid, or "senile", plaques are due to the beta-amyloid peptide, and neurofibrillary degeneration is linked to the hyperphosphorylation of the Tau protein. These two lesions first develop in the hippocampal region of the brain, the seat of memory. The main symptom of Alzheimer's disease - memory loss – comes from this specific location.

If the origins of the disease were to be traced, the amyloid precursor protein (APP) would be near the top of the family tree. *"As implied by its name, APP is the precursor of amyloid, whose accumulation in the brain causes senile plaques. Depending on how it is cleaved by enzymes, it is*

at the origin of two pathways: a predominantly physiological, non-amyloid pathway, and another pathway, whose existence has not been explained, at the origin of the beta-amyloids Aβ40 et Aβ42, among others. It is this last path that is pathological, says Yvette Akwa. "Otherwise, APP has a very beneficial role, as the protein, whose gene is located on chromosome 21, promotes neuronal survival, synapse generation and memory capacity. Like genetic mutations, it is not clear why certain enzymes specifically cleave APP to produce amyloid-beta peptides."

Aβ40 and Aβ42 peptides, derived from APP cleavage, join together progressively, first in the temporal lobe of the brain, near the hippocampus, and then spreading to the entire brain. In parallel to this increasing accumulation outside the neurons, neurofibrillary degeneration strikes inside the nerve cells, through hyperphosphorylation of the Tau protein. Normally, phosphorylation is a natural protein conformation modification mechanism through the addition of a phosphate group to one or more amino acids of the protein, thus modifying its activity. *"The Tau protein promotes the polymerisation of tubulin into microtubules, in the transport of various components in the neuron. Tau has many*

phosphorylation sites, says Yvette Akwa. In fact, as soon as the Tau protein is hyperphosphorylated, it dissociates from the microtubules (which will then disintegrate), falls into the cytoplasm and progressively aggregates to form fibrillar neurodegeneration, leading to the death of neurons.”

This double lesion mechanism that characterises Alzheimer's disease is very slow and generally develops over several decades before the first symptoms appear, including memory disorders (amnesia), language disorders (aphasia) and movement disorders (apraxia).

Glial cells, imaging and early identification of the pathology

The Neurodegenerative Diseases Laboratory (LMN – Univ. Paris-Saclay, CEA, CNRS) carries out the fundamental and mechanistic study of three major neurodegenerative diseases: Alzheimer's, Parkinson's and Huntington's. “The singularity of the LMN lies in our transverse approach to the problem, with studies on the fundamental mechanisms, the cellular interactions and their behaviour, and the use of brain imaging techniques,” says Gilles Bonvento, Director of the laboratory. Within the LMN, there is a particular focus on glial cells, which make up about half the brain and are rarely studied in the context of neurodegenerative diseases.

As their name indicates, these diseases result in the death of neurons, and research has long focused on their operation and the mechanisms related to neurodegenerative pathologies. “We realised late in the game that in Alzheimer's disease, for example, we were not dealing with a ‘cell-autonomous’ disease involving only neurons. Lastly, the death of the neuron is a very late phenomenon in the evolution of the disease,” says Gilles Bonvento. “The circuit failures that account for the clinical symptoms are themselves preceded by clinically silent and slowly progressing cellular processes, at least 20 years before neuronal death. We are now studying these events prior to neuronal death, incorporating new cells, such as glial cells, into the research.”

Glial cells are divided into three categories (astrocytes, microglia and oligodendrocytes) and promote communication between neurons. “Neurons are at the heart of brain activity, but evolution has made them very vulnerable. They require a lot of support cells to function properly,” says Gilles Bonvento. “Our stock of neurons at birth only decreases over the course of our life. Glial cells are not as sensitive and vulnerable to time.”

At the LMN, a dedicated team is working on the contribution of glial cells to the pathophysiology of Alzheimer's disease. It is primarily interested in one type of glial cell in particular, namely astrocytes. One team, led by Caroline Escartin, is studying the interactions between astrocytes and neurons and the phenotypic change in these astrocytes, for example. “This opens up the possibility of identifying new biomarkers for the disease,” adds Gilles Bonvento. “It is essential to detect the disease as early as possible. It is now known that dysfunctions appear long before the first symptoms (memory, orientation or other cognitive problems). Our goal is to have biomarkers at the earliest possible stages of Alzheimer's disease to identify and flag individuals on a trajectory that will lead to the disease.”

The LMN also benefits from its location within the Molecular Imaging Research Center (MIRGen – Univ. Paris Saclay, CEA), located at the CEA centre in Fontenay-aux-Roses and recently equipped with a particle accelerator, the cyclotron, a positron emission tomography (PET) imaging platform and magnetic resonance imaging (MRI). “The cyclotron is essential for the on-site synthesis of radioligands, which will help us to identify biomarkers of Alzheimer's disease through PET imaging. The development of imaging tools to monitor the evolution of the pathology atraumatically is one of the LMN's main research areas,” says Gilles Bonvento. “Today, the monitoring and diagnosis of the pathology must combine batteries of cognitive tests with other examinations. On the one hand, we are developing ligands of interest for monitoring the disease, and on the other hand new MRI approaches to objectify functional changes in the brain. This area uses several imaging modalities such as nuclear magnetic resonance spectroscopy (MRS).”

MRS is a “virtual biopsy” and provides researchers with information on the brain levels of a number of key indicators (amino acids such as glutamate, etc.). Julien Valette, Assistant Director of the LMN, and his team have also developed new spectroscopic methods to quantify certain morphological characteristics of neurons and astrocytes. But this is not a single solution. “With Alzheimer's disease, the difficulty is being selective and sensitive to early events. Lastly, we are seeking to develop a set of relevant arguments to characterise the disease as early as possible. It is likely to be difficult to tell whether a patient has the disease in a single NMR spectroscopy examination. On the other hand, NMR provides additional arguments, which then converge with clinical tests and PET imaging, to make a definitive diagnosis and especially to monitor the effectiveness of therapies.”

Steroids sulphates as treatment?

At the DHNS, Yvette Akwa is interested in pregnenolone, the main precursor of neurosteroids, which are steroids synthesised in the nervous system from cholesterol. “I first became interested in the biosynthesis and metabolism of neurosteroids in rat brains,” says the researcher. Pregnenolone is converted to pregnenolone sulfate in the body. In addition, it has been established that this sulfated molecule stimulates the glutamatergic N-methyl-D-aspartate (NMDA) receptors present at the synapses, the interface between two neurons ensuring the transmission of information between them. NMDA receptors are essential to memory and to the ability of the nervous system to make and break new connections between neurons, which is known as synaptic plasticity.

Furthermore, positive effects of pregnenolone sulfate on memory have been observed. “I have shown that pregnenolone sulfate was promnesiant, that it promoted spatial memory performance, in young animals (mice and rats), and anti-amnesiant in animals aged between 12 and 21 months. It was from these discoveries that I became interested in Alzheimer's disease, as pregnenolone sulfate was able to stimulate memory and reverse memory loss in animals not affected by the disease,” continues Yvette Akwa. According to her studies, the level of pregnenolone sulfate decreases with age, and even more rapidly when patients are affected by Alzheimer's disease. “We quantified neurosteroid levels in samples from different brain regions in elderly patients with and without the disease. These levels have been seen to decrease significantly in the brains of patients with the disease, compared to those without it. But the most important factor lies elsewhere, as the decrease in the amount of pregnenolone sulfate in the brain correlates with high levels of amyloid deposits. Through further studies, we have shown that this neurosteroid has a protective role for the neuron and corrects the symptoms caused by amyloid-beta peptide. Recently, we have also observed a decrease in hyperphosphorylated Tau proteins,” says Yvette Akwa. The researcher has two goals, namely to eliminate the aggregates linked to the disruption of the Tau protein or beta-amyloids, and, just as importantly, to decrease or even prevent the hyperphosphorylation of Tau. Without this abnormal phosphorylation, the protein does not deposit in the cytoplasm of the cell and does not form aggregates. “I am hopeful that compounds like pregnenolone sulfate can both decrease amyloid neurotoxicity and Tau neurotoxicity and, most importantly, restore memory. We would then be fighting a real combination of the three essential aspects of Alzheimer's disease,” explains Yvette Akwa.



Promoting interactions between transthyretin and beta-amyloid peptide

In the Biomolecules laboratory: design, isolation, synthesis (BioCIS – Univ. Paris-Saclay, CNRS, CY Cergy Paris Univ.), Nicolo Tonali is particularly interested in the aggregation of amyloid-beta peptide A β 42 in the brain. The aim of his research is to avoid the formation of these fibrillar species and facilitate the physiological degradation of the peptide. *“In amyloid plaques, we find different proteins such as transthyretin (TTR), whose main role in the blood is to transport hormones. We found that there was a myriad of positive interactions between TTR and A β 42, such as the reduction of aggregates and their toxicity, and the degradation and dissociation of aggregates already formed,”* Nicolo Tonali explains.

Since those initial findings in 2021, he and many of his colleagues have developed a strategy to bring TTR and A β 42 together. Based on mediated proteolysis, the PROTAC (Proteolysis-targeting chimeric) strategy involved forcing the clustering of two proteins – in this case, A β 42 and TTR – with the goal of maximising their interactions and promoting the removal of the amyloid peptide. *“We observed good interaction between TTR and a portion of A β 42 mediated by copper, a metal, incidentally, that is highly present in the brains of Alzheimer’s patients. We want to build a molecule with a peptide linker that is able to both fetch TTR and place it in contact with A β 42, so that the physiological role of the former protein acts on the latter. The final grouping is then evacuated,”* says the researcher.

Alzheimer’s disease remains an extensive and exciting research topic, particularly due to the many mysteries that still surround it. But thanks to new tools, it is becoming possible to better understand it, and researchers hope to detect it as early as possible and develop therapeutic solutions.

Publications

- Akwa Y., Steroids and Alzheimer’s Disease: Changes Associated with Pathology and Therapeutic Potential, *Int. J. Mol. Sci.* 2020.
- Bonvento G., Glycolysis-derived L-serine in hippocampal astrocytes rescues synaptic plasticity and memory loss in a mouse model of Alzheimer’s disease. *Alzheimer’s Dement.*, 2022.
- Tonali N., et al., Application of PROTAC strategy to TTR-A β protein-protein interaction for the development of Alzheimer’s disease drugs, *Neural regeneration research*, 2021.

Title

Research into neurodegenerative diseases under the prism of scientific ethics

Scientific ethics is a fundamental pillar of research as it ensures that the people involved respect fair values and standards, and that science is practised ethically. When it concerns the study of the brain, fundamental research generates very specific problems.

The researchers at the Neurodegenerative Diseases Laboratory (LMN - Univ. Paris-Saclay, CEA, CNRS) are specialists in three pathologies: Alzheimer’s, Huntington’s and Parkinson’s diseases. These three degenerative diseases affecting humans have in common that they lead to the death of neurons. It is therefore crucial for scientists to study the brain as closely as possible to reality. *“To study the different mechanisms of these pathologies, it is important to have complex models that best approximate human brain function. At the LMN, our patients are rodents and non-human primates. In the context of brain study, the proximity between the brains of non-human primates and humans, particularly in terms of size, is particularly vital for us to develop therapeutic strategies,”* explains Gilles Bonvento, Director of the laboratory.


The use of living beings for research, where this is necessary to create relevant animal models of these pathologies, evaluate their behaviour and then study their brain and other organs post-mortem, is a serious issue for scientific ethics. Each experiment requires the approval of the ethics committees on animal experimentation (C2EA) in close partnership with the structures in charge of animal welfare (SBEA), whose role is to monitor the progress of the projects in accordance with their authorisation and ensure the welfare of the animals housed within the establishments. These projects are based in particular on the 3Rs rule (Replace the animal as soon as possible, in particular through simulations or cell cultures, Reduce the number of animals used and Refine the procedures so that the constraints on the animals are minimal and their well-being is preserved as much as possible).



Lastly, a completely different problem is now emerging with Alzheimer’s disease, which

scientists are succeeding in identifying earlier and earlier but without effective treatments. *“Today, it is becoming possible to diagnose a neurodegenerative pathology in a patient with an increasing degree of certainty before its clinical manifestation, but we are unable to treat it effectively afterwards,”* laments Gilles Bonvento. *“What are the consequences of this diagnosis for the patient? Is it positive or not?”* These are questions that deserve to be addressed.



SEEN FROM ABROAD

Journal la Repubblica	Journal TheScientist EXPLORING LIFE, INSPIRING INNOVATION	Journal INSIDER
Title ANTHEA COMELLINI, L'ASTRONAUTA MILLENNIAL	Title THE LONG AND WINDING ROAD TO EUKARYOTIC CELLS	Title SOME NEANDERTHALS COULDN'T SMELL THEIR OWN STINK, SUGGESTS A NEW STUDY RECREATING EARLY HUMANS' NOSES
<p>Più che il sogno di diventare astronauta, Anthea ha sempre avuto quello di trovare il proprio posto nel mondo. Laurea in ingegneria spaziale al Politecnico di Milano. Doppia laurea con la French Grande école of engineering di Tolosa, master all'Università di Paris-Saclay.</p> <p>https://www.repubblica.it/tecnologia/2023/03/26/news/anthea_comellini_lastronauta_millennial-393502737/</p>	 <p>This year, University of Paris-Saclay biologist Purificación López-García embarked with colleagues on a journey into life's ancient past.</p> <p>https://www.the-scientist.com/features/the-long-and-winding-road-to-eukaryotic-cells-7056?_ga=2.200353838.1403010427.1666753497-1684915652.1666340439</p>	<p>Kara Hoover, a biological anthropologist from the National Science Foundation, and Claire de March, a biochemist at the Université Paris-Saclay, reconstructed odor receptors from the genomes of three Neanderthals, one Denisovan, an ancient human, and a database of modern human genomes. It was an attempt to recreate the noses of our closest ancient relatives.</p> <p>https://www.businessinsider.com/some-neanderthals-evolved-to-stop-smelling-body-odor-study-suggests-2023-2?r=US&IR=T</p>

Journal EXPRESS	Journal LA VANGUARDIA	Journal NewScientist
Title RARE CHEMICAL COMPOUND FOUND IN REMBRANDT'S MASTERPIECE THE NIGHT WATCH	Title HORMIGAS ENTRENADAS PARA DETECTAR EL CÁNCER POR EL OLOR DE LA ORINA, DE MOMENTO, EN RATONES	Title HIDDEN CORRIDOR IN EGYPT'S GREAT PYRAMID MAPPED WITH COSMIC RAYS
 <p>Experts believe that the compound was introduced into the painting via a lead-based drying agent such as linseed oil.</p> <p>https://www.express.co.uk/news/science/1722783/the-night-watch-rembrandt-van-rijn-rare-chemical-compound-lead-formate</p>	<p>Un equipo de investigadores de la Université Sorbonne Paris Nord, la Université Paris-Saclay y el Institut Universitaire de France ha presentado los primeros resultados de un estudio que indica que las hormigas podrían ayudar en la detección de algunos tipos de cáncer. Por el momento, este equipo ha conseguido entrenar hormigas para olfatear indicadores de tumores cancerosos en la orina de ratones en ensayos en laboratorio.</p> <p>https://www.lavanguardia.com/natural/20230127/8713911/hormigas-entrenadas-detectar-cancer-olor-orina-momento-ratones.html</p>	 <p>A 9-metre-long corridor in the 4500-year-old Great Pyramid of Giza that was discovered in 2016 has now been mapped, and researchers have used a tiny camera to peer inside.</p> <p>https://www.newscientist.com/article/2362300-hidden-corridor-in-egypts-great-pyramid-mapped-with-cosmic-rays/</p>



Title

COP27: Go and see it to believe it

© Les Agros à la COP



For the past few years, several students and staff from Université Paris-Saclay have been attending the international negotiations organised by the UN within the framework of the Conferences of the Parties – COPs – as observers. This was especially so at COP27 on climate change, which took place in Sharm el-Sheikh (Egypt) from 6 to 18 November 2022. A look back at all the lessons learned.

“I wanted to demystify the COP in the eyes of those around me and my students,” says Morgan Chabanon, lecturer at the Laboratory of Molecular and Macroscopic Energetics, Combustion (EM2C – Univ. Paris-Saclay, CentraleSupélec, CNRS). With Guilhem Dezanneau, a researcher at the Structures, Properties and Modelling of Solids Laboratory (SPMS – Univ. Paris-Saclay, CentraleSupélec, CNRS), they were part of a group of four researchers and six students from CentraleSupélec who went to COP27 to understand how their respective research on porous media and hydrogen fits into the more global issues surrounding climate change. The AgroParisTech students Juliette Combret, Auriane Meiller, Angélique Sarre and Justine Trémeau also went to the summit after being selected with four other AgroParisTech students. Each year, the management of their school provides a group of students with the opportunity to get right to the heart of these international negotiations.

Born after the adoption of the United Nations Framework Convention on Climate Change at the Earth Summit in Brazil in 1992, COPs bring together at regular intervals, in a different country, 197 member states of the United Nations and the European Union, whose countries communicate with a single voice, with the aim of drafting a global agreement on three major issues: climate, desertification and biodiversity. They take the pulse of the international will to act on these issues, with decisions being made by consensus. *“You can only be awed by the immensity of the system. Bringing together so many different countries to discuss climate issues is a real achievement,”* says Angélique Sarre after her participation in COP27 on climate.

COP from the inside

Taking part in this event showed everyone the reality of the debates, the topics tackled and the discussions behind the scenes. *“The negotiation process is slow, and sometimes it takes a whole hour to negotiate just one specific word,”* says Sarre. While some countries hold up negotiations, others may have little say in the process due to lack of representation. Remarkably, *“this Egyptian COP gave a voice to African countries. They described their technological, economic and political struggles against global warming,”* say CentraleSupélec’s lecturers. These observations were shared live by the students of both groups on the social networks set up for the occasion. *“At CentraleSupélec, the initiative to attend COP27 was taken by students, and once there, the young people were very active on social networks. Among other things, they set up a LinkedIn page and posted content on Instagram. In particular, the LinkedIn page made it possible to describe all the issues at stake in the COP negotiations,”* notes Guilhem Dezanneau.

In addition to the UN member countries, COPs also attract lobbyists, companies and associations. Non-governmental organisations (NGOs) take advantage of this opportunity to arrange meetings in parallel with the official sessions. *“At COP27, they discussed the place of indigenous peoples in the negotiations, social justice, peasant agro-ecology and feminism,”* says Auriane Meiller. *“I was struck and moved by the inequalities that were highlighted.”*

Moving among officials and activists over these two weeks of intense debate, the members of Université Paris-Saclay noted some inspiring initiatives. *“For example, the negotiators from some countries had long discussions with civil society,”* recalls Juliette Combret.

Choosing a direction

Back in France, the students from AgroParisTech and CentraleSupélec did not hesitate to share their experience through debates, talks, a podcast and workshops with other students and people in the “Cordées de la Réussite” programme. The experience provided food for thought for everyone. *“COPs should continue. Even when the goals stated are not particularly ambitious, they set a minimum limit on which all participating countries agree,”* says Justine Trémeau. *“Instead of thinking that COPs are of no particular use, we are thinking about ways of*

improving them,” says Angélique Sarre. Juliette Combret completes the idea: *“Seeing with our own eyes the magnitude of the civil mobilisation really made us feel confident. We believe that the solution exists and that it lies in the hands of NGOs, which promote, for example, the importance of agroecology in agriculture.”* *“To move forward together, it is important to promote education and technology transfer,”* notes Guilhem Dezanneau.

What are the results of taking part in the COP? *“At CentraleSupélec, we are thinking about getting more training beforehand, to better understand these sometimes confusing technical debates, and to limit the number of participants depending on the purpose of the COP,”* concludes Morgan Chabanon. The AgroParisTech students add: *“We are concerned about the carbon footprint of our trips. There will be no AgroParisTech delegation at the COP28 climate conference in Dubai (United Arab Emirates) at the end of 2023, which will be chaired by the CEO of an oil company, but a delegation will be present at the Bonn intersessional meetings to continue the AgroParisTech adventure at the COP.”*

<https://www.instagram.com/lesagrosalacop/>

<https://www.youtube.com/@lesagrosalacop>

<https://twitter.com/COPCentraleSup>

<https://www.linkedin.com/company/cop-centrale-supélec/>

https://www.youtube.com/watch?v=3dbH2_V7AB0

Title

Student ambassadors: support for new students



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Université Paris-Saclay offers its students the opportunity to become Université ambassadors or Student Life Supporters for high school students and fellow new students. Their main role is to inform these students of the different support systems, offers and services in place at Université. These individuals share their student experience and try to promote Université's projects by taking part in face-to-face and remote events related to active orientation and public information. The ambassadors also provide support to students in need by directing them to the services that can best help them.

"These paid student jobs are perfect for students because they give them flexibility in organising their working hours, their workplace is close to their place of study, they help with their professionalisation and the students can also have this work recognised in their studies," explains Mathilde Castelli, Coordinator of Student Pastoral Care at the Student Life and Equal Opportunities Department (DVEEC).

The profiles of the people looked for are French or international students from the first year of undergraduate study to the final year of Masters, and with sufficient language skills

in French and potentially English or another foreign language to engage in a basic conversation about their university. *"The selected students receive three hours of training on posture, communication assumptions and conflict management,"* adds Mathilde Castelli. There are also plans to provide training on all the student life mechanisms at the start of the next school year.

<https://www.universite-paris-saclay.fr/programme-detudiants-ambassadeurs>

Title

Aspie-Friendly: inclusion of people with autism at the Université

The Aspie-Friendly programme, launched in 2018, is a ten-year ANR programme that aims to facilitate the inclusion of people with autism in universities by providing them with an adapted and personalised pathway. It is part of the national autism strategy and is currently being implemented in 25 higher education institutions, including Université Paris-Saclay; it supports more than 550 students with a diagnosis of autism spectrum disorders (ASD) throughout France. It is now being extended to include other neurodevelopmental disorders, such as language- and writing-related "dis"orders and attention deficit disorders with or without hyperactivity (ADHD). *"Its particular characteristic is that it is aimed at students with ASD who have social communication difficulties and are often misunderstood by their peers, the academic*

community and university staff," emphasises Ghislain Remy, Student Disability Coordinator at Université Paris-Saclay and the local contact person for the Aspie-Friendly programme.

This programme uses four main components to overcome inclusion issues: developing a transition plan, identifying the necessary educational adjustments, providing support that goes beyond purely educational aspects, and preparing students affected by ASD for social and professional integration.

Université Paris-Saclay is deploying special measures, such as access to psychological and neuropsychological consultations, awareness-raising among academic staff and the student community, and the Café-Asperger, a meeting place for students with ASD. *"Positive signs of improvement in their inclusion have been*

observed, and the academic and administrative staff are becoming increasingly autonomous in supporting these people," concludes Ghislain Remy.

<https://aspie-friendly.fr/>

Title

Student associations take up social issues

With several hundred student associations, Université Paris-Saclay is characterised by its students' commitment to solidarity-based initiatives.

The student-associative field of possibilities is almost infinite at Université Paris-Saclay, from the photography club to the organisation of charity trips and soup runs. *“There is a wide range of associations at the University, from small ten-member associations that get together to have fun to highly professional associations,”* explains G r aldine Carbonel, in charge of association support at Centrale-Sup lec. The common denominators of many associations are support, social actions, and the fight against all forms of discrimination.

The CentraleSup lec-based student association “Esp rance en b ton” (Concrete hope) aims to promote science in working-class districts, particularly in the secondary schools of Les Ulis (Essonne), near the University campus. *“The association is divided into two parts: homework help in mutual aid centres, and tutoring activities for students on a 2-year preparatory course for a competitive exam. Each tutor monitors two students,”* explains Solal Ducloyer, President of the association. The members of Esp rance en b ton also organise the yearly Bouge la science! (Move science!) forum, when hundreds of local students visit CentraleSup lec and other facilities on the Saclay plateau (SOLEIL synchrotron, FabLabs, etc.).

Based at the Jean Monnet Faculty, the student association “Fi res et s eurs” (Proud and Sisters) was created by four Faculty students in 2020 following the resurgence of sexual and gender-based violence against women during the first lockdown. *“We have two main missions: to inform and to create a community of listening, mutual aid and support,”* says Marine-Mich le Okala, co-President of the association, which has around 50 members. On Instagram, they share portraits of women, a feminist dictionary and news about women’s rights. As well as conferences and film discussions, Fi res et s eurs also organises the collection of sanitary protection, as well as a gala, at the end of which the collected funds are distributed to the “Fondation des Femmes” (Women’s foundation).

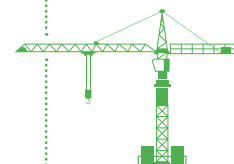
<https://www.linkedin.com/company/esp rance-en-b ton>

https://www.instagram.com/fieres_et_soeurs/?hl=fr



  Christophe Peus

  Esp rance en b ton et PICS



Title

A solidarity centre in the Orsay valley

The repeated crises, whether health or inflationary, have plunged many students into a precarious situation. It is with a view to curbing this dynamic that many social stakeholders at Université Paris-Saclay have joined forces to create a solidarity centre.

Located in building 237 in the Orsay valley, the solidarity centre now comprises a Restos du cœur (a food packages and hot meals distributive charity), the exiled students' union, an Order of Malta food truck and a local Emmaus branch. New solutions for combating student precariousness will soon be created within this centre.

For more than ten years, the AGORAé Paris-Saclay solidarity grocery shop on the Orsay campus has been offering students the opportunity to shop at very low cost. "We offer discounts of up to 90% on market prices," says Solange Audin, President of AGORAé Paris-Saclay. "Our goal is to ensure that students can maintain a decent standard of living despite their precariousness." Workshops (cooking, sewing, etc.) also allow the creation of social links between grocery users. AGORAé plans to join the solidarity centre in building 237 shortly.






The development of a solidarity centre also involves a global approach to the problems of precariousness, which are not limited to food. The Sport Planète thrift store, which opened in building 311 in November 2022, offers sports equipment and materials for sale and rent to all Université students, without social or sectoral distinction. "We realise that it is particularly difficult for some students in Science and Techniques of Physical and Sports Activities (STAPS) to buy sports equipment during their studies, especially when the equipment is only used for one semester. We want to take up the issue of the ecological transition and also combat sedentary lifestyles, isolation and precariousness in students," says Martin Ray, President of the STAPS student office. "I think we have a complementary approach to the rest of the solidarity centre in that we offer different services with the common goal of making student life easier," he concludes.



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WE WERE THERE			NOT TO BE MISSED			Date	Location	Host
APRIL			MAY			16	Henri Moissan Building, 17 avenue des Sciences, 91400 Orsay	Université Paris-Saclay
Date 30/03 to 11/04	Location University of Evry	Host University of Evry	Date 31	Location Lehmann Amphitheatre, IJCLab building 200, rue André Ampère, 91400 Orsay	Host Université Paris-Saclay, Centre d'Alembert	Title "ONE WORLD ONE HEALTH" COLLOQUIUM, MULTIDISCIPLINARY APPROACHES AT THE UNIVERSITY OF PARIS		
Title "COMICS & SOCIOLOGY" EXHIBITION			Title "WHAT SHOULD CHANGE IN OUR RESEARCH?" SYMPOSIUM			Description This colloquium aims to bring together researchers from Université Paris-Saclay who are sensitive to the theme of global health to encourage the emergence of new multidisciplinary work. The "Global Health" working group, which cuts across all Université's Graduate Schools, is using this conference to present its initial work. https://www.dataia.eu/evenements/colloque-un-monde-une-sante-approches-pluridisciplinaires-au-sein-de-luniversite-paris		
Description In the heart of the University of Evry library, visitors were able to discover the work of researchers and PhD candidates in sociology in the unusual form of comic strips. https://openagenda.com/universite-paris-saclay/events/expo-bd-and-socio			Description Organised as part of the UNESCO International Year of Basic Sciences for Sustainable Development, this symposium aims to highlight sustainable research practices. https://www.universite-paris-saclay.fr/actualites/colloque-sciences-fondamentales-et-developpement-soutenable-que-faudrait-il-changer-dans-nos-recherches			Date 26/06 to 07/07		
MAY			JUNE			Location Faculty of medicine Paris-Saclay, 63 rue Gabriel Péri, 94276 Le Kremlin-Bicêtre		
Date 5	Location 68 rue Houdan, 92330 Sceaux	Host "Fières et sœurs", Jean Monnet Faculty	Date 8	Location ENS Paris-Saclay	Host MRES Graduate School	Title PUBLIC HEALTH AND EPIDEMIOLOGY SUMMER SCHOOL OF BICÊTRE		
Title CHARITY GALA ORGANISED BY THE STUDENT ASSOCIATION "FIÈRES ET SŒURS"			Title MULTIDISCIPLINARY JUNIOR CONGRESS					
Description The student association "Fières et sœurs", founded at the Jean Monnet Faculty, organised a gala featuring speakers and a raffle; the evening was in support of the Fondation des Femmes (Women's Foundation), which received all the proceeds from the event. https://www.helloasso.com/associations/fieres-et-soeurs/evenements/gala-de-charite			Description The multidisciplinary Junior Congress of Université Paris-Saclay's Research and Higher Education (MRES) Graduate School returns for its second event on 8 June at ENS Paris-Saclay. Third-year undergraduate and Master's students will present their research topics through posters, video presentations and oral communications. https://www.universite-paris-saclay.fr/gs-mres-congres-junior#home164371			Description The summer school includes theoretical teaching in the fields of biostatistics, epidemiology and computer science and more specific practical teaching on the formulation, resolution and discussion of concrete problems in public health. https://www.eespe.universite-paris-saclay.fr/en/home/		

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READING HIGHLIGHTS

Students actively protesting against the pension reform: an unprecedented mobilisation?

Robi Morder, a member of the Laboratory Professions, Institutions, Temporalities (PRINTEMPS – Univ. Paris-Saclay, UVSQ, CNRS) and co-President of the Study and Research Group on Student Movements (Germe – UVSQ), has examined the role of the unprecedented student mobilisation against the pension reform, the demands of the young demonstrators and the new types of action added by the student unions.

<https://theconversation.com/les-etudiants-engages-contre-la-reforme-des-retraites-une-mobilisation-inedite-202674>

Does the doctors' oath signify a new stage in the dialogue between science and society?

Since January 2023, doctors of all disciplines have had to take an oath, at the end of their PhD, obliging them to respect scientific integrity during their career. What impact does this new practice have? What do PhD candidates think about it? Sylvie Pommier, Vice-President of the doctoral programme at Université Paris-Saclay, and Bertrand Granado, a researcher at Sorbonne University, have attempted to answer these questions.

<https://theconversation.com/avec-le-serment-des-docteurs-renouveler-le-dialogue-entre-sciences-et-societe-201107>

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THE FIGHT AGAINST SEXUAL AND GENDER-BASED VIOLENCES (SGBV) AT UNIVERSITÉ PARIS-SACLAY

“So that shame and fear change sides.”

Key Figures

10 000

people targeted
by the e-learning
module

1

dedicated
harassment unit

1

equality and
diversity unit (MED)

1

partially formed
to SGBV disciplinary
division

+60

staff members
involved

“Put an end to variable geometry indignation.”

Training

38

training sessions
(full or half day) and
“flash” awareness-raising
sessions (1h - 2h)

400

staff members formed

1 500

students, leaders
of students' associations
and student
representatives trained

1

SGBV e-learning module
(opening in September
2023)

Two courses (one “student” course
and one mandatory “supervisor”
course, to take prior to registration
to Accreditation to Supervise
Research or HDR)

“Zero SGBV tolerance.”

Employer Perimeter Unit: how it works



A strong link with
existing facilities



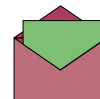
A restricted
first-sorting cell

composed by Anaïs Bohuon
(professor at Université
Paris-Saclay and Gender-
equality project manager)
and the Chief of Staff
at Université Paris-Saclay



One anonymous
reporting form

<https://www.universite-paris-saclay.fr/faire-un-signalement>



One dedicated
e-mail address

harcelements@universite-paris-saclay.fr



Free speech
at the University

since 2018, the number of
cases handled by the unit has
increased considerably