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L'Édition

université PARIS-SACLAY

Prizes and awards
at Université Paris-Saclay

Researchers


© Arnaud Chevron-Gustave Roussy

Suzette Delaloge
alumnus of the Faculty of Medicine at Université Paris-Saclay and director of Gustave Roussy's Interception for personalised cancer prevention programme, is the laureate of the **Prevention Prize in the first edition of the Science and Health Personalities Awards** presented by the newspaper *L'Express*. She was rewarded for her dedication and the range of projects she has overseen in the fight against breast cancer.


© Florent Ginhoux

Florent Ginhoux
director of the Myeloid Cells and Cancer Laboratory within the Anti-Tumour Immunology and Cancer Immunotherapy research unit (ITIC - Univ. Paris-Saclay/Inserm/Gustave Roussy), is the winner of the **Chair of Excellence in Biology-Health of France 2030** and the recipient of a 2-3 million euros grant to support his work on his scientific project entitled MATCH - Mapping microglia - tumour crosstalk to cure pediatric brain cancer.


© Fondation pour la recherche cardio-vasculaire

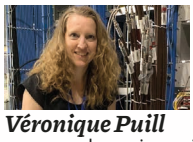
Mathilde Keck
a researcher in the Molecular Engineering for Health Department of the Medicines and Technologies for Health laboratory (MTS - Univ. Paris-Saclay/CEA/INRAE), has been awarded the **"Cœurs de femmes" grant** by the Cardiovascular Research Foundation for her research project entitled "Regulation of the AVP/Apelin balance in pre-eclampsia".


© Wendy Mackay

Wendy Mackay
director of research at Inria and head of the Ex-Situ team, shared by the Interdisciplinary Computer Science Laboratory (LISN - Univ. Paris-Saclay/CNRS/Inria/CentraleSupélec) and Inria Saclay, has received the **ACM SIGCHI Lifetime Research Award**, presented by the Association for Computing Machinery (ACM), for her contribution to research in the fields of human-computer interaction.


© Franck Montmessin

Franck Montmessin
CNRS research director at the Atmospheres, Environments and Space Observations Laboratory (LATMOS - Univ. Paris-Saclay/CNRS/IPSL/UVSQ/Sorbonne Univ.), has been awarded the **David Bates Medal** by the European Geosciences Union (EGU) for his contribution to understanding the interrelationships between the Martian water cycle and the geological history of the Red Planet.


© Véronique Puill

Véronique Puill
a research engineer in particle detector development and director of the Detectors and Instrumentation Department at the Irène Joliot-Curie - Physics of Two Infinities Laboratory (IJCLab - Univ. Paris-Saclay/CNRS/Univ. Paris-Cité), was awarded the **Srodogora prize** by the CNRS Foundation, in recognition of her career, which has been marked by a genuine commitment to science.


© Daniel Shulz

Daniel Shulz
CNRS Research Director and Head of the Department of Integrative and Computational Neuroscience (ICN) at the Paris-Saclay Neuroscience Institute (NeuroPSI - Univ. Paris-Saclay/CNRS), has been awarded a Nature Award for Mentoring in Science, in the Lifetime achievement in mentoring category, by the journal *Nature*, for all his mentoring activities, which contributed to the development and success of young researchers.

Students

© École universitaire de premier cycle Paris-Saclay

Stella Bermond
a student in Marketing Technique university technology degree (BUT) at the Sceaux University Technical Institute (IUT), won **first prize from the jury in the "***Mon apprentissage en 180 secondes***"** (My work-study programme in 180 seconds) competition for her presentation of her work-study programme at Mauboussin.

Maxence Bouinière
a student in Physical Measurements at the Orsay IUT, was awarded the **public prize** for his presentation of his work-study programme at CEA Paris-Saclay.


© IUT d'Orsay

The team from Orsay IUT
came 2nd in the **National Physical Measurements Challenge**, an annual event organised by all the Physical Measurements departments of France's IUTs, focusing on measurement and metrology.

The team from the Faculty of Pharmacy
at Université Paris-Saclay was awarded the *Académie de pharmacie* (Academy of Pharmacy) **prize** at the very first national hackathon for faculties of pharmacy, organised around the theme of oncology, for its project to develop an application to detect chemo-induced cognitive disorders.

Companies & Projects

Institut DATAIA
Artificial Intelligence (AI) Institute of Université Paris-Saclay, is one of the nine winners of the **IA-Cluster** call for expressions of interest launched in 2023 as part of the national strategy for AI. These nine clusters of excellence in AI research and education will be supported to the extent of 360 million euros by the France 2030 initiative.

ION-X
a start-up founded in 2021 and the result of a collaboration between the Centre for Nanoscience and Nanotechnology (C2N - Univ. Paris-Saclay/CNRS/Univ. Paris Cité) and Airbus Defence and Space (ADS), is one of the 42 new prize-winning companies in the **European Innovation Council (EIC) accelerator programme**. The project aims to develop and industrialise space propulsion systems.

Three young innovative companies set up by alumni of Université Paris-Saclay were awarded **SPRING 50** prizes at the Paris-Saclay SPRING 2024 exhibition:

Highcast
created by two CentraleSupélec alumni, Flore de Lasteyrie and Vivien Robert, and winner in the Industry & Services category, develops artificial intelligence that helps industrial facilities reduce their electricity costs by optimising the planning of their activities;

Rewake
founded by Paul Forget, an engineering graduate of CentraleSupélec, and Alban Catoire, and winner in the Cleantech category, specialises in the trade-in, reconditioning and resale of research and laboratory equipment;

VITROPEP
founded by Christophe Tarabout, an alumnus of Université Paris-Saclay, and a winner in the Health Biotech category, is developing an intradermal injection patch capable of replacing needle and syringe injections.

I intend to use all of my energy and experience to serve our university, its projects and future.

© Corinne Hameau

Editor's letter

On 11 June 2024, I had the honour of being elected president of Université Paris-Saclay, a research-intensive university, invested in its local area, and recognised for its scientific excellence and social diversity. I intend to use all of my energy and experience to serve our university, its projects and future, and commit myself fully to ensuring that the university continues to succeed locally, nationally and internationally.

2024 is a special year. The Olympic Games will return to France this summer, a century after the first Paris Olympic Games took place in the capital. This year, France will host the Paralympic Games for the first time. At Université Paris-Saclay, sport and inclusion also take pride of place, as you will see in this new issue of *L'Édition*.

This issue looks at the university's sport management programmes and the exciting opportunities they have provided for some of our graduates at the Paris 2024 Organising Committee for the Olympic and Paralympic Games. We also explore the particularly active and multidisciplinary study of physical and sporting activities. While some of the university's researchers are tackling questions about gender and equality in the sporting world, others are studying our muscles to gain a better understanding of the biological processes at work when we exercise.

In terms of innovation, you will see how certain research has led to concrete applications for top athletes, physiotherapy patients or sportspersons of all ages and levels. The Paris 2024 Olympic and Paralympic Games are also an opportunity for Université Paris-Saclay to promote physical activity among its students and staff, with initiatives such as the EUGLOH connected walking challenge, or parasports workshops organised on the university's various campuses.

Nonetheless, this issue of *L'Édition* has not neglected the many other fields which make up the wealth and diversity of our university and its ecosystem, just like the SaclAI-School, an innovative training programme in artificial intelligence, coordinated by the DATAIA Institute. You will have stars in your eyes reading about the work led by researchers using the James Webb Space Telescope to study protoplanetary disks. Back on solid ground, you can learn all about the new genome editing techniques in plants and the role they have to play in the transition towards more sustainable and environmentally-friendly agriculture.

I hope that you will enjoy reading this issue, and I look forward to seeing you next autumn for a new issue of *L'Édition*. I wish you a wonderful summer!

Camille Galap,
President of Université Paris-Saclay.

Sports management

A field of study that's proving its worth at Université Paris-Saclay

Over the past year, the Organising Committee for the Olympic and Paralympic Games (OCOPG) has multiplied its workforce to meet the immense challenge that organising this major world sporting event presents. A golden opportunity for many alumni of the Faculty of Sports Sciences at Université Paris-Saclay, which offers a whole range of education pathways focusing on sports management.

The Paris 2024 Olympic and Paralympic Games will bring together nearly 15,000 athletes for 29 days of competition at 61 venues across France. More than 4,000 employees of the Organising Committee for the Olympic and Paralympic Games (OCOPG) will also be working behind the scenes to ensure the smooth running of the events, including alumni from the Faculty of Sports Sciences at Université Paris-Saclay.

"The 2nd year Master's degree SLEM prepares students for careers in sports events, sports marketing, sports sales, sponsorship and event organisation, while the 2nd year Master's degree PPSOS prepares them to work on public policy or in sports organisations such as federations," explains Michel Desbordes, professor and head of the 2nd year Master's degree SLEM.

One of the Faculty's missions is indeed to provide education for professions linked to the management and organisation of physical and sporting activities for all types of audiences, which is why it offers a full pathway focusing on sports management.

"We have many former students who have joined the OCOPG. Some students from this year's graduating classes are also doing their internships there," confirms Christopher Hautbois, Dean of the Faculty. *"It's a source of pride for us to see them pursuing a professional career that matches their aspirations. It gives us a sense of accomplishment."* One of the Faculty's missions is indeed to provide education for professions linked to the management and organisation of physical and sporting activities for all types of audiences, which is why it offers a full pathway focusing on sports management.

Degrees with an established reputation

The pathway is part of the STAPS (Science and Techniques of Physical and Sports Activities) field of study and starts at undergraduate level. *"Specialisation in sports management begins in the second year of the degree, then continues in the third year with courses entirely focused on this field,"* adds the Dean and professor at the Faculty. Once they have obtained their bachelor's degree, graduates have the option of continuing their studies at Master's level, with two possible specialisations in the second year: on the one hand, the SLEM (Sport, leisure and event management) pathway, and on the other, the PPSOS (Public Policies and Strategies of Sports Organisations) pathway.

Like the second one, this first degree is not new. SLEM was created in 1999, and PPSOS in 2004. And both have made a name for themselves. While the number of sports management courses has multiplied in recent years, particularly in business schools, *"our track record and reputation are our strong points,"* asserts Michel Desbordes. All the more so given that both education pathways have evolved over time.

Since 2020, the 2nd year Master's degree SLEM, for example, has been entirely taught in English. *"In the world of sports management, working teams have become much more globalised. By following the careers of our alumni, we realised that a lack of English could be a barrier,"* the head explains. In the wake of this adjustment, international students are now joining the Master's programme.

Gaining exposure to the professional sector as early as possible

"Whatever pathway they follow, we want to give everyone the chance to experience the professional sector as early as possible," explains Christopher Hautbois. This is another crucial aspect of the Sports Management field of study. *"Thanks to our location in the Paris region, we've built up a very extensive professional network,"* adds

© Faculté des sciences du sport

Michel Desbordes. Every year, speakers from a wide variety of backgrounds come to share their experiences with the different classes.

But, more than anything, this discovery of the professional sector involves internships, from the third year of the undergraduate degree right through to the Master's degree. *"The SLEM pathway is divided into a six-month course and a six-month internship. And the PPSOS pathway is available as a work-study programme,"* explains the Dean of the Faculty. Similarly, right from undergraduate degree level, the courses include numerous projects, including the famous Noctiraid. Organised for the last fifteen years by the 2nd year Master's degree SLEM students, this night-time team raid, combining trail running, mountain biking, orienteering, shooting and a bike & run, attracts some 300 participants every year.

"It's really in the DNA of this Master's programme to educate its students in the organisation of major sporting events. There aren't always Olympic and Paralympic Games, but, including in France, there are always international sporting events to be organised somewhere," explains Christopher Hautbois. *"Thanks to our alumni network, we often hear from each other. And this confirms that we have a remarkable rate of professional integration."*

"Organising the Olympic and Paralympic Games,

An unbelievable experience!"

The Paris 2024 Olympic and Paralympic Games are an exceptional event that won't be happening again anytime soon. But for some alumni of the Faculty of Sports Sciences at Université Paris-Saclay, it's also a dream come true.

"Organising the Paris 2024 Olympic and Paralympic Games is a crazy and unbelievable experience!" says Emma Bouttier. A 2023 graduate of the Faculty of Sports Sciences at Université Paris-Saclay, this alumnus is one of thousands of employees of the Organising Committee for the Olympic and Paralympic Games (OCOPG) who have been hard at work for months preparing for this major global sporting event. *"I'm operations coordinator at one of the Olympic and Paralympic venues – the North Paris Arena, in Villepinte - where boxing, fencing, modern pentathlon and sitting volleyball events will be held,"* she explains. *"My role is almost like being the orchestra conductor of the whole site,"* which will welcome up to 10,000 spectators a day during the Olympic and Paralympic Games. It goes without saying that the challenge is a major one.

When Emma Bouttier began her career in sports management a few years ago, she never imagined she would one day embark on such an adventure. *"It was in my third year of undergraduate studies that things really clicked for me. That year, we had to organise sporting events from start to finish, and that opened my eyes to what I wanted to do in the long term,"* she recalls. *"At Université Paris-Saclay, we have the chance to really put what we learn into practice. And you learn so much working on the ground. You realise what you like and don't like, and what you need to work on."*

The student soon found herself in the field, first in her undergraduate degree and then in her Master's degree, specialising in SLEM (Sport, leisure and event management). It was then that she completed an internship at the Stade de France, where she was subsequently recruited as an events production manager, donning her first hat as an orchestra conductor. *"It's a job that requires you to consider lots of different aspects and take an overall view. In that sense, I've learned a lot from the events organised throughout my education,"* says the young woman who, after the Paris 2024 Olympic and Paralympic Games, will be returning to the Stade de France team.

The Olympic and Paralympic Games: the perfect opportunity for all profiles

Like Emma Bouttier, Nathan Billard graduated from the 2nd year Master's SLEM programme in 2023. Also like her, he embarked on the ambitious adventure of the 2024 Olympic and Paralympic Games. *"I'm the accreditations officer for the Oceania National Olympic and Paralympic Committees,"* explains the alumnus. *"It's a demanding but very interesting job. There's a lot of administration, but also a lot of sport. It really makes the most of my versatile profile."* Indeed, Nathan Billard hasn't worked in sports management his whole career.

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After six years studying economics, management and international management, he joined Université Paris-Saclay and the 2nd year Master's SLEM programme. *"The aim was to get a general education in management and administration, before finishing by specialising in sport,"* explains the young man, who completed part of his studies in the United States and Spain. *"I really wanted to make this seventh and final year worthwhile. Today, I have absolutely no regrets. The 2nd year Master's degree SLEM was a rich year that helped me develop the skills I needed to work in the world of sports."*

Although he didn't land a Master's internship at OCOPG as he had hoped, the dream eventually became reality. *"I've been thinking about working for the Olympic Games for many years. It was one of the reasons why I decided to enrol in the 2nd year Master's SLEM programme. After graduating, I tried my luck again, and perseverance paid off in the end,"* enthuses Nathan Billard, who intends to enjoy the adventure to the full despite a very busy schedule.

From spectator to Olympic Games coordinator

Lise Domas, too, has long dreamt of playing a part in the organisation of the Paris 2024 Olympic Games. In summer 2012, she and her family attended the Olympic Games in London. *"It was an incredible experience and it made me want to work for the Olympics,"* says this alumnus of the Faculty of Sports Science. The following year, she enrolled in a STAPS undergraduate degree, then moved into sports management to complete the 2nd year Master's degree SLEM.

In 2017, while on an internship with the French Canoe-Kayak Federation, her Olympic dream resurfaced. *"During this internship, I helped to organise the Olympic Day in June 2017. It was the very beginning of the process, and Paris' bid for 2024 had not yet been accepted,"* recalls Lise Domas. But at the time, 2024 was still a long way off. The student continued on her career path, finding a series of experiences to develop her network of contacts. *"We work in an environment where networking is very important. And our education plays a big part in helping us to create one. Being based in the Paris region is also helpful in gaining more experience."*

Graduating from the Master's programme in 2018, Lise Domas has held a number of positions, until finally fulfilling her dream. In autumn 2023, she joined the OCOPG as coordinator of site and infrastructure deliveries for the Golf national located in Guyancourt. *"My role is to coordinate the installation of the temporary infrastructures that will enable the site to host the Olympic golf events,"* she explains. *"It's very demanding, but I really enjoy what I do. And it's really satisfying to see that I've achieved the goal I set myself so long ago. It's also a unique experience because it will never happen again."* At least not in France, although the sports enthusiast is already thinking about repeating her Olympic adventure with the Milan Winter Olympics in 2026.

SaclAI-School

Artificial intelligence for everyone at Université Paris-Saclay

Led by the DATAIA Institute of Université Paris-Saclay, the SaclAI-School project aims to draw up a broad, ambitious and innovative education programme in artificial intelligence (AI). Since 2021, SaclAI-School has brought in several new courses and modules, as well as introducing student scholarships and tutoring.

"Artificial intelligence has come on leaps and bounds in recent years. It's everywhere now, in our society, our daily lives, our phones. So there's a real need to understand the advantages and challenges, and also the risks and limitations," explains Frédéric Pascal, Director of the DATAIA Institute, the artificial intelligence (AI) institute at Université Paris-Saclay. Training everyone in AI is the mission of the SaclAI-School program run by the Institute. Funded to the tune of 11.4 million euros, this programme is one of the winners of the *Compétences et métiers d'avenir* (CMA, meaning Skills and Professions of the Future) call, launched at the end of 2021 by the French National Research Agency.

"SaclAI-School aims to train the general public in artificial intelligence, in the core disciplines of AI, computer science and mathematics, and also in interdisciplinarity, by coupling AI with other disciplines in which it plays a transformative role," explains Sarah Cohen-Boulakia, co-head of the SaclAI-School project and deputy director of education at the DATAIA Institute.

The strength of the project lies in the fact that it draws on all the skills of Université Paris-Saclay and the unique ecosystem of the DATAIA Institute, which brings together 46 different research laboratories and over a thousand researchers in the field of AI and its applications.

Some sixty courses from 1-year higher education diplomas to PhD

Since its launch, the programme has significantly increased the number of university students trained in AI, from first-year university students to Master's degrees and PhDs. Four new Master's courses have started, as well as two thematic courses within the Mathematics, Vision and Learning (MVA in French) Master's programme at ENS Paris-Saclay, two international courses at CentraleSupélec and a specialised Master's degree in trusted AI, in collaboration with the SystemX Institute for Technological Research (IRT in French). Numerous innovative teaching modules have been designed, thanks in particular to the recruitment of some fifty associate professors from the socio-economic world.

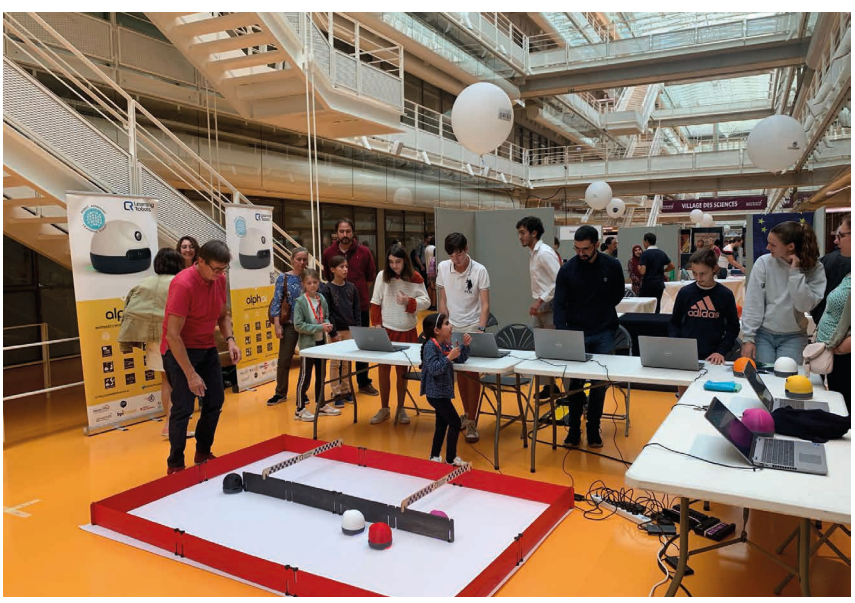
In addition to developing the range of courses on offer, *"our aim is to provide the best possible support for students involved in AI-related courses,"* explains Cristina Porlon, the SaclAI-School project manager. It is with this in mind that MixtAI scholarships are awarded each year to candidates from first-year university students to those on Master's degrees. A peer tutoring programme - TutorIA - is also in place to provide support in the IT and mathematics programmes.

Short courses accessible to all, at any age

SaclAI-School's mission is not only to train AI experts within the University, but also to get as many people as possible familiar with the current challenges of AI. This is where the BrevetAI comes in, based on the learning-by-doing method which ensures discovery of AI in the form of activities adapted to all levels.

The challenges of AI are also numerous in lifelong learning. In collaboration with the CentraleSupélec Exed ongoing education centre, *"we provide a wide selection of courses covering the main areas of AI,"* explains Meryem Kafnemer, SaclAI-School's ongoing education project manager. From short adaptation and awareness courses (complete introduction to AI, ChatGPT, digital twins, AI and the environment, ethical and legal issues of artificial intelligence, etc.) to longer, more in-depth courses, there's something for every level. The catalogue doesn't stop there, as customised training courses are also put together for companies. *"The idea is to understand their needs and provide them with training based on real-life cases adapted to their own business sectors,"* continues Meryem Kafnemer.

> *"Artificial intelligence has come on leaps and bounds in recent years. It's everywhere now, in our society, our daily lives, our phones. So there's a real need to understand the advantages and challenges, and also the risks and limitations."* — Frédéric Pascal



© Institut DATAIA

Since its launch at the start of the academic year in 2022, SaclAI-School has trained over 1,200 students in AI, and a further 1,300 have undergone adaptation. Other initiatives are under development, with the arrival of two interactive online courses, as well as the launch of several teaching support platforms. The idea is that AI shouldn't hold (almost) any secrets for anyone.

https://www.dataia.eu/en/formations/saclai-school

My thesis in 180 seconds

"This experience unlocked something in me"

Every year, PhD candidates from Université Paris-Saclay take part in the *"Ma thèse en 180 secondes"* (My thesis in 180 seconds, MT180) competition, hoping to make it to the national and international finals. We take a look back at the experiences of three former Université Paris-Saclay candidates.

The three former candidates, from left to right : Elise Bordet, Isabelle Hoxha and Ombeline Labaune. © Angélique Gilson

Three minutes, and not a second more, to explain your research project clearly and concisely but convincingly, to an uninitiated audience. All with the support of a single slide. There is no doubt that MT180 is a complex exercise. Yet every year, dozens of PhD candidates from Université Paris-Saclay embark on this adventure. All the way to the Université finals, where the most talented of the 15 or so contestants must win over the jury and the public.

Dare to have a go

Elise Bordet was one of these finalists in 2018: *"Doing this competition during my thesis was a bit stressful. But I don't regret it for a second, I have good memories of it,"* confides the young woman. Like many participants, the student hesitated before taking the plunge. *"I knew about MT180 but I didn't dare sign up. Then I attended a presentation by a PhD candidate from my laboratory who had entered the competition. It encouraged me and showed me that it was possible."*

After registration, there are several half-days of education to practise public speaking, eloquence, stage presence and more. *"It was all new to me. It's a very special and complicated exercise. The most difficult thing is to explain what you are saying in layman's terms because to us it sounds clear, but in reality, it's not at all,"* explains Elise Bordet, whose thesis focused on the "innate and adaptive immune response of pigs to the porcine reproductive and respiratory syndrome virus".

A salutary step back

For Ombeline Labaune, MT180 finalist in 2020, this is precisely the point of the exercise. *"Popularising your subject is the hardest part, but it's also the most interesting. That's why I was there. It forced me to set aside time to step back from my subject and think about how to talk about it simply,"* explains the PhD candidate, who entered the competition in the second year of her thesis on "the vigour of human movement: from action to cognition". *"During the preparation phase, there is also a lot of very useful interaction with other PhD candidates and trainers. You realise that you share the same presentation issues, even though your subjects are completely different,"* she points out. During her participation, 2022 finalist Isabelle Hoxha also saw everyone progress, gaining in ease and expression with each passing week.

"I think reaching out to people and explaining what we do in the labs is a really important part of being a scientist. With MT180, you learn a lot in terms of disseminating science," confirms the PhD candidate whose thesis focused on "neurocognitive mechanisms of perceptual anticipation in decision-making".

Developing new capabilities

With MT180, you also learn how to manage stress. Because there is a lot of stress on the big day when it is time to take to the stage for the Université final. *"The first thing I remember about my presentation is the journalist asking me if I was ready, and my voice was so small because I had a lump in my throat. My hands were shaking and my heart was pounding during my presentation,"* recalls Isabelle Hoxha. *"But when I watched my presentation, I saw that it didn't show at all. It means our training had paid off! "* And what a success it was, as the candidate was awarded the Jury Prize in the 2022 competition. The award took her to the semi-finals and then to the national final in Lyon.

"I never thought I would get that far. I went into the competition with no ambitions, and at each stage of qualification, I was really surprised when I heard my name."

The same stress and unexpected qualification awaited Elise Bordet in 2018. She won the Audience Prize and went on to the national final in Toulouse, before presenting her thesis a few months later. *"The final was another factor in building my self-confidence and public speaking skills. Before that, I didn't know how comfortable I could be. I feel like MT180 unlocked something in me. It taught me to manage form and content, and to put myself forward,"* continues Elise Bordet.

Profitable lessons

Five years later, this experience prompted the young woman to embark on a new adventure, as she co-founded the 2082 association, whose aim is to help women negotiate their salaries. *"Even today, women earn 25% less than men on average. 2082 is the estimated year of equal pay for men and women,"* explains Elise Bordet. *"Our aim is to help women build up their self-confidence and combat 'imposter' and 'good girl' syndromes."*

Isabelle Hoxha, meanwhile, defended her thesis one year after taking part in MT180, in July 2023. *"The competition helped me improve my public speaking skills. I even reused a science outreach section at the very beginning of my dissertation to introduce the subject,"* smiles the researcher, who is now a member of the Cognitive Studies Department at the École normale supérieure (ENS).

In 2020, Ombeline Labaune did not have the chance to continue the experience as far as the national final, which was cancelled due to the Covid-19 pandemic. *"The final at Université Paris-Saclay was a very special moment because it was on that evening that the closure of Université and the shops was announced,"* she recalls. *"But I have very fond memories of my time on stage."* This experience reinforced her taste for science outreach, and the following year she put teaching aside to devote herself to this. This is a second hat that Ombeline Labaune, now a lecturer at the Faculty of Sport Sciences of Université Paris-Saclay, still wears today: *"I manage the outreach workshops and other events we take part in to make sport sciences accessible to the general public."*

Three minutes on stage and three different experiences, but the three young women have just one piece of advice for any PhD candidates who may be hesitating: *"Go for it and sign up for MT180!"*

https://mt180.fr/

Just Do Maths!

Women in mathematics take a stand against stereotypes

The *Just Do Maths!* exhibition brings together ten portraits of female mathematicians from Université Paris-Saclay, with the aim of raising awareness of gender issues in mathematics. After visiting Lumen and IHES, the exhibition will travel to different Université campuses until 2025.

© Emeline Férard

In early April, the Institut des hautes études scientifiques (IHES in French - Institute of Advanced Scientific Studies) in Bures-sur-Yvette hosted a brand new exhibition. Proudly displayed on panels were portraits of ten women who all have one thing in common, namely that they are mathematicians. *Just Do Maths!* proclaims the exhibition poster. The message could hardly be clearer. But the aim of the event goes far beyond that.

Ten female mathematicians with different careers

"We initially wanted to publish new portraits on the Université Paris-Saclay website, as mathematics is poorly represented there and female mathematicians even less so," explains Maëva Fézas, Education Manager at Université's Graduate School Mathematics, who initiated the project. *"And then we asked ourselves what would be the best format to encourage people to read these portraits. That's when we came up with the idea of adding a photo exhibition, combined with events - meetings, conferences and debates."*

In collaboration with Université's different constituent faculties and institutes, schools, associate institutions and partner national research organisations, the GS Mathematics team finally selected ten women mathematicians whose career paths and research themes are presented on the exhibition panels. Applied calculus, topological data analysis, geostatistics, numerical analysis and more. Their work provides a glimpse into the many different worlds and applications associated with mathematics.

"We wanted the portraits to cover a wide range of topics, in both applied and fundamental mathematics, and to be taken from several laboratories. We also wanted to highlight women mathematicians with slightly different careers, who are involved in university life on a daily basis as academics, education managers, internship supervisors or mentors," explains Maëva Fézas.

Mathematics, one of the disciplines with the lowest female representation

Women in mathematics to break stereotypes and inspire female students. Just Do Maths! is not just a photo exhibition, it is also a pretext for raising awareness of gender issues in mathematics and the place of women in this discipline, which continues to have one of the lowest rates of female representation in higher education and research in France.

"In 2022, women accounted for 22% of the academic and research staff in mathematics," confirms Catherine Goldstein, mathematician and historian of mathematics, at a conference held at the IHES to coincide with the launch of the *Just Do Maths!* exhibition there. And the trend does not seem to be reversing - quite the contrary.

"The figures show that the situation is very stable in France. In the 1990s, the proportion of women in the discipline was already around 22%," explains the historian. In some branches, the numbers are even lower. *"A few years ago, one of our colleagues, Christian Kassel, claimed that female pure mathematics lecturers were an 'endangered species' that could disappear by 2050."*

A "catastrophic" reform for maths teaching

Mélanie Guenais, mathematician at Université Paris-Saclay and Vice-President of the French Mathematical Society, spoke at the Lumen exhibition opening in March, denouncing another worrying situation caused by the latest secondary school reform. Adopted in 2018, this reform abolished compulsory mathematics teaching at secondary school level.

This had the effect of more than halving the number of girls on science courses, *"clearly exacerbating gender inequalities."* As a result, the proportion of girls fell back to the levels seen in the 1960s. *"We have regressed 60 years,"* notes Mélanie Guenais.

While this reform dealt another blow to the teaching of the subject, the problem of non-parity in maths has many different roots. Stereotypes are one of them, as is sexism, which is still very prevalent, points out Mélanie Guenais. But the lack of women in maths and their low visibility lead to a lack of female role models that also helps to maintain this non-parity, according to Clémence Perronnet, sociologist and co-author of the book *Matheuses - Les filles, avenir des mathématiques* (Female mathematicians - Girls, the future of mathematics - CNRS Editions, 2024), who was also invited to give a lecture at IHES in conjunction with the exhibition.

In a sociological study carried out at a summer maths camp, *"two-thirds of the girls present told us they had never met a female researcher or engineer,"* she pointed out during her talk. *"We believe that having role models, whether real or fictional, with whom to identify is key to projecting yourself. But there are still far too few female scientific role models and they are not diverse enough."*

The exhibition will tour until 2025

Just Do Maths! aims to fill this gap with its ten portraits of women mathematicians from all walks of life. And the touring exhibition is just beginning its journey across Université's campuses, thanks to the different entities that have collaborated with the GS Mathematics team to give the project greater scope.

After an inauguration at Lumen and a stopover at IHES and ENS Paris-Saclay (21 May - 13 June), the exhibition will move on to AgroParisTech (13 June - 5 July) and CentraleSupélec (5 July - Sept). After the start of the 2024 academic year and until March 2025, it will then move to the Mathematical Institute of Orsay, the Orsay University Library, the Versailles Faculty of Science campus and the Université d'Évry campus.

All the portraits are also available on the Université website.

https://www.universite-paris-saclay.fr/graduate-schools/graduate-school-mathematiques/mediation-et-actualites-graduate-school-mathematiques/just-do-maths-nos-mathematiciennes-contre-les-stereotypes

Research

Business & Innovation

Sport and gender

What is the situation in the run-up to the Paris 2024 Olympic Games?

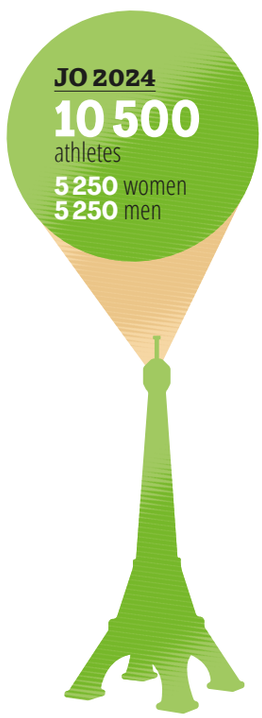
10,500 is the number of athletes expected at the Paris 2024 Olympic Games (OG), with just as many women as men. This is one of the commitments of the next Olympiad, namely to become the first equal gender games in history. This has never happened before in 32 editions, and for a reason, as until today, sport has been far from a model student when it comes to parity and inclusion.

Keywords

Olympic Games
—
Gender verification
—
Inclusion

The Olympic Games (OG) are undoubtedly one of the world's greatest sporting events in terms of the number of nations represented, the number of sports played, the number of spectators and the number of athletes involved. However, women have not always been welcome. Not a single woman was among the 241 athletes invited to the first Olympic Games of the modern era, held in Athens in 1896 at the instigation of Pierre de Coubertin. It was not until the following Olympiad, in Paris in 1900, that sportswomen made their debut. A total of 22 women - compared with 975 men - competed in six disciplines, including tennis and golf.

An initial victory? Not really, according to Florys Castan-Vicente, a lecturer at the Complexity, Innovation, Motor and Sport Activities Laboratory (CIAMS - Univ. Paris-Saclay/Univ. Orléans). *"Their presence was not officially recognised by the International Olympic Committee (IOC), which considered their events to be demonstrations. They did not win medals, they won diplomas,"* explains the social historian. It was not until the 1908 London Olympics that the IOC made women's participation official. That year, 37 women competed, representing just 2% of all athletes. This was a very low rate that continued for several Games.



"Women's bodies are said to be wounded, permanently ill. They must therefore be confined to inactivity to protect their bodies and preserve their procreative capacity."
— Florys Castan-Vicente

An "impractical, uninteresting, unsightly" Olympiad

The slow arrival of sportswomen onto Olympic fields is no coincidence. It illustrates the obstacles women face at an early age in accessing physical activities. *"Sport is a stronghold of virility that has been built on the exclusion of women since the early 19th century. The first sports clubs were founded by men, and it was openly written in their statutes that women were excluded,"* confirms Anaïs Bohuon, lecturer and Head of the Bodies, Sport, Gender and Power Relations team at CIAMS.

In the 19th century, the number of disciplines open to women could be counted on the fingers of one hand. However, there were many arguments in favour of limiting or even banning women's activities. Some cited questions of modesty or lack of elegance. *"There was also this idea that seeing a woman do sport is ugly. This argument is regularly found in the literature and archives,"* adds Florys Castan-Vicente, who wrote her thesis on the links between physical activities and feminisms in France.

In addition to these moral and aesthetic considerations, there were biological arguments widely conveyed by medical discourse, claiming that women were too weak to take part in sport. *"It's the myth of the eternally wounded,"* adds the researcher. *"Women's bodies are said to be wounded, permanently ill. They must therefore be confined to inactivity to protect their bodies and preserve their procreative capacity."* All these arguments led to a very active rejection of sportswomen at the time, including by Pierre de Coubertin, who felt that *"an Olympiad with females would be impractical, uninteresting, unaesthetic and improper."* But some voices spoke out against this exclusion, including that of a little-known figure in the history of sport, Alice Milliat.

A French passionate athlete who was widowed at the age of 24, Alice Milliat *"played a key role in the institutionalisation of women's sport,"* says Florys Castan-Vicente. In 1919, she became head of the *Fédération des sociétés féminines sportives de France* (French Federation of Women's Sports Societies, FSFSF), with which she organised competitions in a range of disciplines. That's how the first French women's football team was founded. In 1921, she took another step forward with the creation of the Fédération sportive féminine internationale (International Women's Sports Federation, FSFI). On two occasions, Alice Milliat asked the IOC to open athletics events to women. To no avail. She decided to take matters into her own hands.

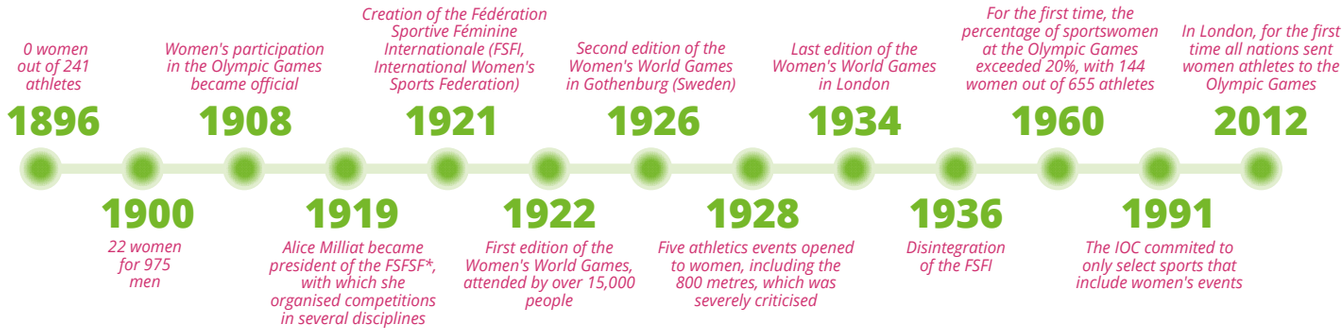
In August 1922, with the FSFI, she organised the first Women's World Games in Paris. The event brought together 77 athletes from five countries who competed in different disciplines, including athletics. *"These first Women's World Games were a success, attracting over 15,000 spectators,"* says the social historian. It was a first endorsement for Alice Milliat and her federation, which repeated the event in 1926 in Gothenburg, Sweden.

The women's 800 metres in 1928

After intense debate, the IOC finally decided to open five athletics events to women, including the 800 metres, at the 1928 Olympics in Amsterdam. The event was won by Germany's Lina Radke in 2 min 16 s 9, beating the world record. However, it was not this feat that made the headlines, but the *"unfortunate spectacle of the finish."* Newspapers described runners collapsing *"half-dead"* on the track, suffering from *"vomiting"* and *"first-class nervous breakdowns."* Except that the videos of the event showed a very different scene.

The nine competitors are shown crossing the finish line. Only one collapses briefly, while the others simply appear exhausted by the race or disappointed by their defeat. According to Florys Castan-Vicente, this 800 m was the subject of a genuine disinformation campaign, *"today, we would call it fake news. This rumour*

INCLUSION OF WOMEN IN THE OLYMPIC GAMES



** Fédération des sociétés féminines sportives de France, (French Federation of Women's Sports Societies)*

spread internationally like wildfire, with exactly the same descriptions in French, British, Australian and New York newspapers." And the disinformation campaign bore fruit. *"It was used as evidence of women's inability to run long distances."* As a result, the IOC and the International Athletic Federation banned women from all races over 200 m. It was not until 1960, in Rome, that the women's 800 m event made its return to the Olympics.

European Athletics Championships in Budapest saw the introduction of a new measure, called "gender verification". Reserved for sportswomen, the procedure was designed to *"confirm the gender identity of female competitors,"* with the stated aim of *"avoiding fraud by preventing any men from competing with women,"* explains Anaïs Bohuon in her book on this "gender verification", later known as "femininity tests".

> *"Sportswomen were expected to have skill levels below those of men. So, they tried to define what a real woman should be by her physical inferiority to men."*
> — Anaïs Bohuon

Using the argument of their alleged biological inferiority, *"there was a kind of 'desportivisation' in women's access to sports,"* says Anaïs Bohuon. *"They were made to run shorter distances, the number of hurdles was reduced and the weights were made lighter. They were also banned from all sports deemed too violent,"* for which less violent versions were introduced, deemed more suitable for women. *"'Barrette' is a good example."* This sport is similar to rugby, with the notable difference that tackling is forbidden.

Despite the many advances of the early part of the century, the 1930s saw a sharp decline, due to the international economic crisis. *"There was also a rise in fascist ideologies, which took a very dim view of sportswomen, their activities and their independent organisations,"* stresses Florys Castan-Vicente. The FSFI did not survive. The last Women's Games were held in London in 1934. The federation went out of business two years later. Alice Milliat retired from the sporting scene. The Second World War saw the return of restrictions for women, who were banned from football, rugby, boxing and cycling.

"Gender verification" for sportswomen

After a long period of inactivity, the '60s saw a revival in women's sporting activities. But they also provided a new example of the unequal treatment of the sexes in the world of sport. In 1966, the

The creation of this test reflected the criticisms and suspicions that emerged very early on about female performance. *"Sport is a discipline that disrupts and transforms morphologies,"* stresses the researcher. For women, however, these transformations have a particular resonance. In the '20s, athletes were subjected to a real "virilisation process", where their bodies were deemed too powerful, too muscular, too hairy... For some women, the remarks went so far as to cast doubt on their membership of the female sex and accuse them of not being "real women".

"Gender verification" aimed to put an end to this controversy. In 1966, it involved a gynaecological examination and strength tests to assess muscle power and respiratory capacity. *"It was very revealing,"* notes Anaïs Bohuon. *"Sportswomen were expected to have skill levels below those of men. So, they tried to define what a real woman should be by her physical inferiority to men."* But it was first and foremost the *"very humiliating"* way in which the verification was carried out that was criticised, as the athletes lined up naked while waiting to show their genitals to three doctors, according to the testimonies collected by the lecturer.

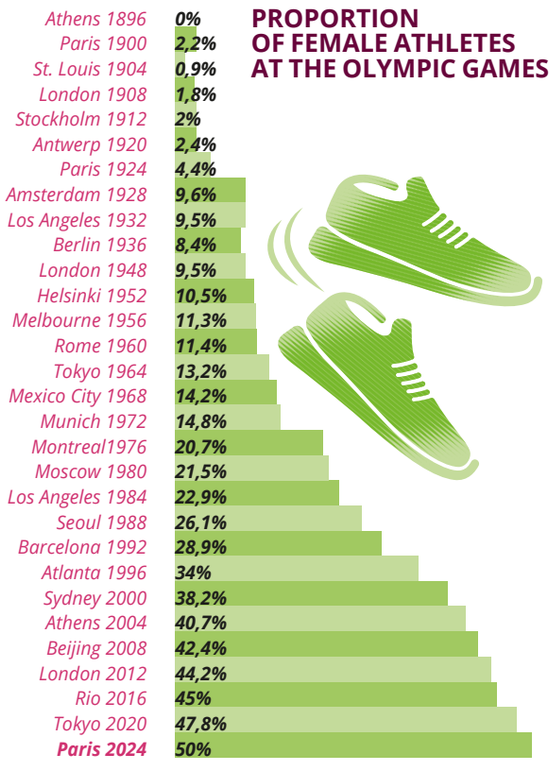
In 1968, this test was replaced by the Barr body test, which aimed to reveal the presence of a second X sex chromosome. As XX individuals are considered genetically female and XY male, the test was supposed to confirm the sexual identity of sportswomen. In 1992, the Barr body test, deemed too unreliable and prone to misinterpretation, was replaced by the PCR/SRY test, this time seeking to establish the absence of a Y chromosome.

However, this new test, like the previous one, came up against a major difficulty in the face of intersex, as some people turn out to be X0, XXY or XY with (partial or total) insensitivity to androgens. All these features can lead to a "mismatch" between genetic sex and physical appearance. With these tests, *"the sporting authorities realised how difficult it is not only to determine a person's sex, but also to define what constitutes a 'real woman' authorised to compete,"* comments Anaïs Bohuon.

By shaking up sex and gender norms, *"intersex totally calls into question sexual bi-categorisation - the strict separation of the sexes - on which the sporting world has been built."* What can be done with these cases of gender-based differentiation? Do these characteristics confer a physical advantage over other sportswomen? These are all questions that the debates struggled to answer. In the 2000s, the IOC abolished systematic and compulsory testing, but authorised tests to be carried out if there was any question regarding a sportswoman's gender identity. It was in this context that the Caster Semenya case emerged.

This young South African athlete excelled at the 2009 World Athletics Championships in Berlin, where she won the women's 800 m in 1 min 55 sec 45. The comments soon began to fly: her shoulders were considered too broad, her voice too deep, her musculature too large... Examinations revealed that Caster Semenya suffered from hyperandrogenism, in other words an production of testosterone deemed excessive. From then on, *"for the Athletics Federation, the IOC and then other federations, it was hormonal sex, i.e. the level of testosterone, that defined what a real woman authorised to compete should be,"* recounts Anaïs Bohuon. Except that *"testosterone is not the miracle hormone for sports performance. And all the studies have great difficulty showing that testosterone alone enables athletes to excel."*

Despite this, regulations have only become stricter since 2011. Initially set at 10 nanomoles of testosterone per litre of blood (nmol/L), the limit has been lowered to 2.5 nmol/L for certain federations,



including athletics. And sportswomen with hyperandrogenism have to undergo treatments to lower their hormone levels. Caster Semenya denounced their side effects and took the case to court. *"Today, there are many sportswomen who will not be taking part in the Olympics this summer because they don't accept the regulations that impose hormone treatments on healthy bodies,"* explains Anaïs Bohuon. These athletes will not be the only ones to miss out on the Olympics. The same will be true for transgender sportsmen and women.

"Sport is one of the most disinvested spaces for trans people because it is one of the most violent to stay in after transitioning." — Lucie Pallesi

The inclusion of transgender athletes in question

The term "transgender" (or trans) describes a person whose self-identified gender identity does not correspond to the gender assigned to them at birth. A trans woman, for example, is a person who defines themselves as female but was assigned the male gender at birth. Conversely, "cisgender" (or cis) people are those whose lived identity and assigned gender are the same. If they wish to do so, trans people have the option of making a transition to help their appearance match their gender identity. This may include medical procedures such as hormone therapy and/or sex reassignment surgery.

While intersex and trans-identity are two different things, they raise similar debates about the inclusion of the athletes concerned. These debates centre around the same question, namely physical advantage. Do trans women have an advantage over other sportswomen? *"The entire scientific community disagrees,"* explains Lucie Pallesi, PhD candidate at CIAMS who has been working on a thesis on trans-identity in top-level sport for the past five years. *"The problem is that some base their arguments on extrapolations from studies carried out on men and women. But a trans woman is not a cis man. There are studies on trans women and they say that the physical advantage is reduced or even disappears after transition."*

As with intersex athletes, the rules have evolved over the years. After imposing hormone therapy and sex reassignment surgery on trans women, and then setting a testosterone limit, the IOC reconsidered its position and finally abandoned the criteria. In 2021, it published a framework in which it acknowledged the lack of consensus on the impact of testosterone on performance. This was a first in the sporting world.

"We might have expected a wave of inclusion after this publication, but the opposite happened," laments Lucie Pallesi. Several federations, including rugby, athletics and cycling, updated their rules to ban trans women from competing. *"These regulations exclude all trans women who have experienced male puberty. This means transitioning before the age of 12. But no country currently allows that at such a young age."* And it is not out of the question that other federations will follow suit.

According to Lucie Pallesi, there are barely a hundred openly transgender athletes competing at high level. New Zealand weightlifter Laurel Hubbard is one of them. In Tokyo in 2021, she became the first trans athlete to compete in an Olympic event, despite a barrage of criticism. *"Sport is one of the most disinvested spaces for trans people because it is one of the most violent to stay in after transitioning."* points out the CIAMS PhD candidate.

Considering only the biological argument is *"forgetting all the socio-economic conditions that come into play. For a trans woman, a career in top-level sport is very precarious,"* continues Lucie Pallesi. This is also where arguments take a wrong turn according to Anaïs Bohuon. Whether intersex, transgender, female or male, biology is not everything when it comes to sporting performance. *"Physical advantage is indefinable,"* she asserts. *"To understand who excels in top-level sport, we need to consider a whole range of components, biological as well as historical, social, economic, political and geographical."* Surfing, which will be included in the Paris 2024 Olympics, provides an example.

Female surfers deprived of waves

While women's surfing has been on the rise for several years now, it is not without its challenges. *"Even today, many private surfing competitions do not invite female surfers,"* says Anne Schmitt, a researcher at CIAMS who focuses on gender inequalities in surfing and sailing. *"And female surfers had to fight to get access to some of them."* This was the case in Mavericks, California, one of the world's most iconic surf spots, where sportswomen were unable to enter the competition until 2018, 19 years after it was first held.

Another example is the location chosen for the upcoming Olympic surfing events, to be held in Teahupo'o, Tahiti. The area is known for its impressive but also dangerous waves. *"There is very little bottom when the wave forms. So, anyone who falls has a high chance of hitting the coral and sustaining serious injuries,"* confirms the sociologist. Although the Tahitian waves have long been part of the men's professional surfing circuit, the event was withdrawn from the women's circuit in 2006 for safety reasons. It was not reinstated until 2019, following the choice of venue for the 2024 Olympics.

This detail is not insignificant for Anne Schmitt. *"We too often forget that performances are rooted in a cultural and social context. When you restrict women's practice for so many years, you create a lag,"* she asserts. *"This summer, if a woman underperforms at Teahupo'o, it will be seen as a sign of weakness and non-legitimacy, even though she has only been training there for two years, compared to the men, who have been riding this wave for over ten years."*

For female surfers, the restrictions are compounded by another difficulty, namely the economic reality of a sporting career. *"Surfing is expensive; you have to travel the world, transport your equipment and pay for your registrations. Training also requires time and the right conditions,"* explains the sociologist. *"One of the most effective ways to get paid is to be sponsored."* But here again, there are fewer opportunities for sportswomen who, for a long time, had to deal with the *"sexy female surfer cliché"* fostered on them by sponsors. Lastly, prize money is another illustration of inequality in surfing, as it is only since 2019 that female surfers have received prizes equivalent to those of their male counterparts when they win competitions.

Unequal pay, poor media coverage, compulsory dress, sexist comments, sexual violence, exclusion... Despite the progress made in these areas in recent years, many gender-related issues remain in the world of sport. And the 2024 Olympics will be no exception. *"Olympic Games with as many men as women is a great step forward,"* says Florys Castan-Vicente. But *"parity does not mean equality."*

In fact, this summer, there will still be no women in Greco-Roman wrestling or the decathlon. For their part, men are still unable to compete individually in artistic swimming or rhythmic gymnastics. And there will be no parity in the Paralympic Games due to the lack of female para-athletes.

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Protoplanetary disks

In the eye of the James Webb Space Telescope

That was two years ago. On 11 and 12 July 2022, the James Webb Space Telescope (JWST) revealed its first infrared images of the Universe, including "the deepest and sharpest ever produced", according to NASA. This marked the start of scientific operations for the space observatory. It has made a steady stream of discoveries since then, notably regarding protoplanetary disks, the disks of gas and dust where planets form.

The JWST was intended to usher in a new era in astronomy. Two years after delivering its first images, it already seems to have lived up to its promise in the eyes of the scientific community studying its data. *"We have currently accumulated more than 150 hours of JWST observation. This represents around 50 protoplanetary disks observed, an exceptional data set,"* enthuses Benoît Tabone, researcher at the Institute of Space Astrophysics (IAS - Univ. Paris-Saclay/National Centre for Scientific Research, CNRS).

Protoplanetary disks are one of the targets that the JWST has focused on since it was commissioned. They are at the heart of the MINDS (MIRI mid-Infrared Disk Survey) observation programme, which brings together an international team of scientists including Benoît Tabone and Alain Abergel from IAS, and Pierre-Olivier Lagage from the Paris-Saclay Astrophysics, Instrumentation and Modelling Laboratory (AIM - Univ. Paris-Saclay/CNRS/CEA/Université Paris Cité).

Both the AIM laboratory and the IAS are part of the European consortium responsible for the design, construction and assembly of one of the JWST instruments, the MIRI (Mid-InfraRed Instrument) spectro-imager. As a result, they benefit from Guaranteed Time Observations (GTO) programmes, to which the MINDS programme belongs. This programme aims to explore protoplanetary disks located around stars ranging from the mass of our Sun (nearly 2×10^{30} kg) to masses ten times smaller.

From molecular clouds to the birth of stars and planets

Scientists are so interested in protoplanetary disks because they are an essential link in the life cycle of stars and the formation of planetary systems. It is within these disks that planets are born.

It all begins in molecular clouds, immense clouds composed of a dense mixture of gas and dust. Under the effects of a disturbance, certain parts of the cloud may lose their stability and collapse in on themselves. They then produce star embryos called protostars. *"These objects are only a few tens or even a hundred thousand years old. For a star, this represents the equivalent of just a few hours of human life,"* explains Benoît Tabone.

At this stage, the protostar is still surrounded by a cluster of gas and dust, which continues to collapse in on it, forming a very dense cocoon. The embryo grows over the following hundreds of thousands of years as it feeds on the collapsing matter. The temperature and pressure inside the protostar gradually rise until nuclear fusion reactions begin at its core, and the embryo becomes a star. It is during this same process that the protoplanetary disk is formed from the mixture of gas and dust that orbits the young star.

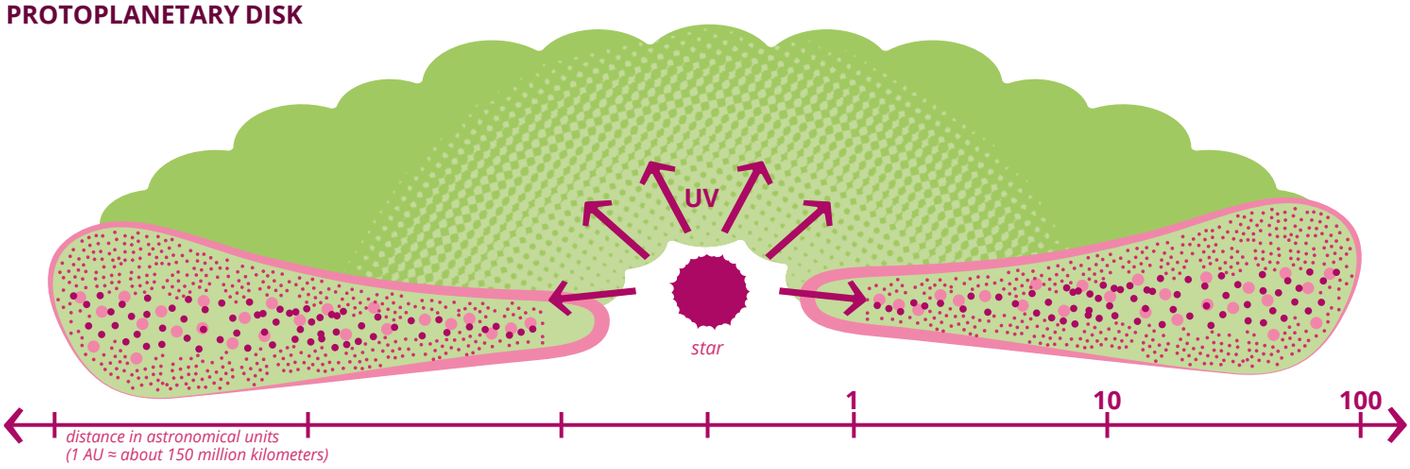
According to observations, this disk can reach a diameter of a few hundred to a thousand astronomical units (an AU is equivalent to around 150 million kilometres) for a mass of 0.001 to 0.3 solar masses. But its structure is not uniform, as its thickness varies according to the distance from the central star, giving it a bow-tie shape. Its density and temperature also fluctuate depending on this distance. Scientists distinguish between the inner disk, closest to the star, and the outer disk.

A protoplanetary disk survives for several million years, during which time planets are formed. This same chain of events was also at the origin of the Sun and the solar system. Around 4.6 billion years ago, a molecular cloud collapsed in on itself, giving rise to an embryonic sun and a protoplanetary disk. Then matter gradually aggregated to form the Earth and the seven other planets in the solar system.

Keywords

JWST — Molecular cloud — Stars — Planets

PROTOPLANETARY DISK



But how exactly do planets form in a disk? Under what conditions? And why do some regions produce rocky planets like Earth, while others produce gas giants like Jupiter? This is what astrophysicists are now trying to determine by studying disks.

The JWST reveals disk material in detail

The concept of the protoplanetary disk as the cradle of planets dates back to the 18th century. But it was not until the end of the 20th century that scientists gained any real insight into the structure of these disks. After initial data in the millimetre range, in 1992, Hubble became the first telescope to spatially resolve disks around the stars of a nebula located a thousand light-years (9.46×10^{12} km) from Earth.

This accelerated with the launch of the ISO (Infrared Space Observatory) telescope in 1995, followed by Spitzer in 2003, and the deployment in 2011 of ALMA (Atacama Large Millimeter Array), the array of antennas installed in Chile's Atacama Desert. *"Planet formation is a very active subject, with many theories. It's only in the last ten years that telescopes have become powerful enough to scan the disks closest to us, at least 300 light-years away,"* comments Benoît Tabone. Like ISO and Spitzer, whose mission ended in 2020, the JWST operates in the infrared range, down to wavelengths of 27 micrometres (µm), but with 100 times greater sensitivity. This should usher in a new golden age of protoplanetary disk observation. *"The JWST's strength lies in its ability to observe hotter gas (100-500 °C) in the disk region close to the star, including regions where Earth-like planets are expected to form,"* explains the astrophysicist.

The strength of the JWST lies in its MIRI instrument. This technological gem comprises two separate components, the MIRIm imager and a medium-resolution integral field spectrometer, MRS. A veritable *"chemical machine"*, this instrument analyses the molecules in the disk that modify the light emitted by the star. The result is an emission spectrum in which each molecule has its own characteristic signature. *"Thanks to the MRS, all the lines in the spectrum are much finer, so we can see much more detail and access all the molecular content of the gas,"* confirms Benoît Tabone. The case of GW Lup, a young low-mass star located around 500 light-years away in a region called Lupus 1, provided the first example of the JWST instrument's capabilities.

By analysing its emission spectrum, the MINDS team gained insight into the chemical and physical conditions that exist within the inner disk surrounding the star. It detected the presence of carbon dioxide (CO_2), water (H_2O), hydrogen cyanide (HCN), acetylene (C_2H_2) and hydroxyl (OH). It also observed an isotope of carbon dioxide, $^{13}CO_2$. A first in a protoplanetary disk.

Another more surprising case from the same programme is that of J160532, a star ten times less massive than the Sun, located around 500 light-years away in the Scorpio-Centaurus group of stars. When astronomers turned the MIRI spectrometer onto the disk surrounding the star, they obtained a rather unusual spectrum. *"We discovered that the disk is surprisingly rich in hydrocarbons,"* explains the IAS researcher.

The spectrum revealed a very large quantity of acetylene (C_2H_2), as well as two molecules previously unknown in disks: benzene (C_6H_6) and diacetylene (C_4H_2). Conversely, water and carbon dioxide, which are regularly detected in other disks, appeared in small quantities.

Which disk for which planetary system?

All these discoveries are invaluable to astronomers. Determining the chemical composition of disks is crucial for a better understanding of the planet formation process. This could be used, for example, to establish a link with other parameters, such as the composition of exoplanet atmospheres. *"Imagine revealing a region very rich in carbon in a certain area of the disk, around all the stars, and at the same time finding gaseous planets that are very rich in carbon. This would indicate that these planets accreted their mass in this precise region,"* explains Benoît Tabone. But the situation seems far from simple.

One of the findings of the MINDS programme is that disks actually have a surprisingly diverse chemical composition. *"When we look at the emission spectra of two disks, they are always different. While one is rich in hydrocarbons and poor in oxygen, the other is poor in gas but rich in silicate grains... The story is quite different each time."* Now, different disks necessarily imply different planetary systems. So how do we know which disk produced which system of planets? This is what scientists are hoping to understand using a statistical approach.

"From the observed sample, the aim is to gauge and quantify the differences to try and extract similarities or regularities in the properties of these disks. For example, are the disks around low-mass stars generally very rich in hydrocarbons? Are the disks around higher-mass stars richer in oxygen? The statistical approach will help us to establish links," explains the astrophysicist.

An "interstellar laboratory" in the Orion Bar

In the eye of the JWST, another disk acts as an "interstellar laboratory". It is called d203-506 and is located in the Orion Bar, 1,350 light-years away, in one of the closest and therefore most studied star nurseries to Earth. Object d203-506 differs from the above-mentioned disks in one important respect, namely that it is what astronomers call a proplyd, an irradiated protoplanetary disk. This is because it is exposed to the powerful ultraviolet radiation emitted by the massive stars of the nearby Trapezium Cluster. These stars are 30 times more massive and 200,000 times brighter than the Sun. In other words, they impose extreme conditions on every object in their vicinity.

These regions exposed to the radiation of massive stars are the target of another JWST programme: PDRs4All (or Radiative feedback from massive stars as traced by multiband imaging and spectroscopic mosaics), of which Émilie Habart, Head of the IAS Astrophysics of Interstellar Matter (AMIS) team, is one of three co-PIs (Principal Investigators). During the telescope's first five months of operation, scientists captured data within the Orion Bar. And d203-506 appeared in a new light.

In this case, it is not the disk itself that the JWST is observing, but the "photo-evaporated" gas coming out of it. *"Because of the UV radiation from the massive star, some of the gas is torn from the disk and escapes in the form of a wind,"* explains Marion Zannese, PhD candidate in the IAS AMIS team involved in the PDRs4All programme. And this wind escapes quickly, very quickly. Analysis of the dihydrogen present shows that the d203-506 disk, whose estimated mass is ten times that of Jupiter (1.9×10^{29} kg), loses the equivalent of 10^{-8} to 10^{-6} solar masses per year. In other words, the disk would lose almost all its gas in less than a million years.

"With such a loss rate, the disk will probably not have time to form a gas giant planet like Jupiter," says the astrophysicist. This example suggests that massive stars play a significant role in planet formation processes within the disks they irradiate.

The equivalent of a terrestrial ocean destroyed and formed per month

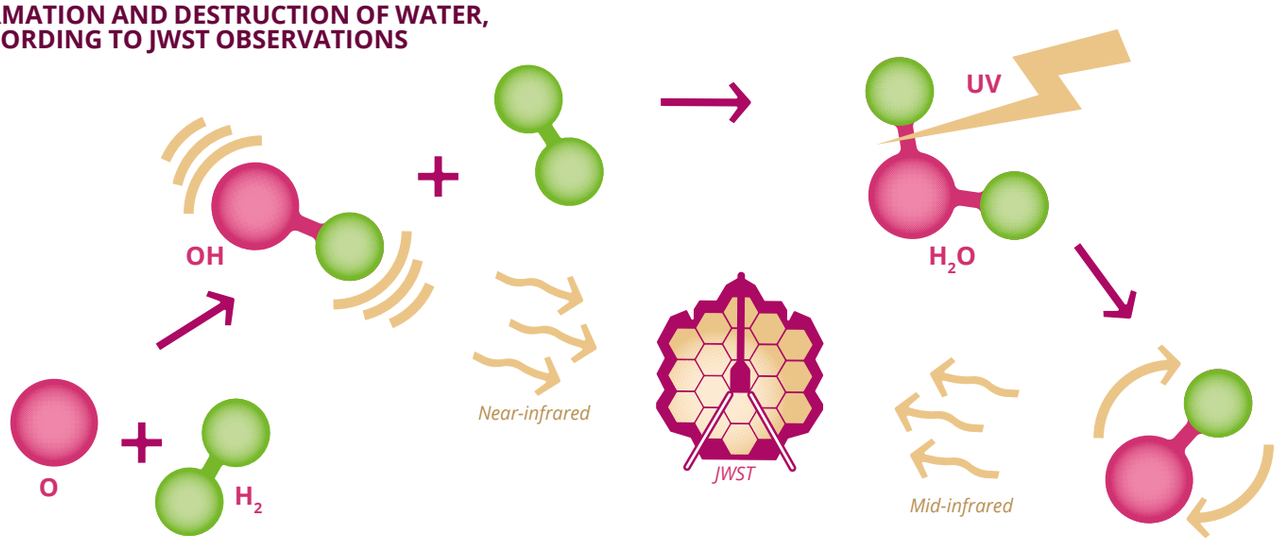
The gas wind captured by the JWST instruments also provides further information on the reactions taking place within d203-506. *"Wind material does not have the same characteristics as disk material. Its density is much lower and its temperature is probably different too. But the atoms present are the same as in the disk."*

This is where the study of this gas comes in. By dissecting the infrared light spectra delivered by MRS, the PDRs4All team has identified a water cycle. *"It was not really the water we were looking at,"* says Marion Zannese, who led the work. *"We detected a molecule characteristic of the presence of water in this disk: hydroxyl (OH)."*

In addition to this single molecule, a two-stage reaction was revealed. When a water molecule (H_2O) is photodissociated - destroyed by UV radiation - it produces an OH molecule in a state of extreme excitation. *"This molecule is spinning so fast that it is ready to break, too. Its excitation then subsides level by level."*

During this process, the OH molecule produces a very characteristic spectrum, which is precisely what the wind from d203-506 exposes. *"This is something we have detected elsewhere, but it is the first time we have observed particularly excited lines with the JWST."* As well as confirming this reaction, the results quantify the amount of water destroyed per unit of time. *"Based on the intensity of the lines, we calculated that the equivalent of a terrestrial ocean, i.e. approximately all the water molecules in the Earth's oceans (5×10^{46}), is destroyed in this disk every month,"* explains Marion Zannese.

FORMATION AND DESTRUCTION OF WATER, ACCORDING TO JWST OBSERVATIONS



A second OH spectrum, captured in the near infrared, also demonstrated a particular state of excitation, but the scientists had yet to identify which one. Collaboration with Spanish physicists provided the missing pieces. *"These scientists performed calculations to determine what quantum state hydroxyl is in when it forms in the gas phase. In astrophysics, these were calculations that we were incapable of doing,"* emphasises the PhD candidate. Once the calculations were completed, there was no doubt that this characteristic spectrum reflected a reaction between oxygen and molecular dihydrogen (H_2), in other words, the first step towards the formation of a water molecule. Once quantified, the reaction appeared more important than the photodissociation phenomenon. In conclusion, if the equivalent of a terrestrial ocean appears destroyed every month within the d203-506 disk, it would also be reformed there.

This discovery has implications for the formation of planets within disks. It could also help us to better understand the origin of water on Earth, and in particular the abundance of deuterium ^2H - a hydrogen isotope - in terrestrial oceans.

Combining specialties to exploit JWST data

Showing what the telescope is capable of, and developing tools to help the scientific community exploit its data are the main objectives of the JWST's initial Early Release Science (ERS) programmes, of which PDRs4All is a part. While the detection of this water cycle opens up a new way of characterising the matter present in disks, it also demonstrates the importance for astrophysicists of working closely with specialists from other disciplines.

At the Molecular Science Institute of Orsay (ISMO - Univ. Paris-Saclay/CNRS), scientists are also working on JWST data. *"We conduct laboratory experiments designed to reproduce conditions in space, so that we can analyse the observations made by telescopes,"* confirms Emmanuel Dartois, Head of the Molecular Systems, Astrophysics and Environment (SYSTEMAE) team at ISMO.

Thanks to these experiments, Bérenger Gans, Marie-Aline Martin, Ugo Jacovella and Laurent Couvert from ISMO, as part of an international collaboration, are contributing to another discovery in the d203-506 disk. At the heart of this study is a peculiar band that appears around 7 µm in the emission spectrum of the disk. After running models and ruling out all the classic molecules that fall into this spectral region, the verdict is that it is the methyl cation (CH_3^+). *"The CH_3^+ spectrum was not known. It had not been precisely measured in the laboratory. So we had to work to confirm that this was a plausible hypothesis and then make a fine attribution,"* asserts Emmanuel Dartois.

This is the first time the CH_3^+cation has been observed outside the solar system. *"Detecting this molecule in the interstellar environment was a real turning point, because we have long believed that CH_3^+ was the origin of many other hydrocarbon species,"* says Marion Zannese. *"This very interesting detection enables us to check whether all gas-phase hydrocarbons are indeed formed from this species."*

A history rebuilt brick by brick

Methyl cation, benzene, a water cycle... After just two years of data collection, the JWST has provided a rich harvest of discoveries about protoplanetary disks and planet formation. But the space telescope takes the story back a little further. *"The JWST allows us to probe deeper into regions and observe stages that we had not seen before,"* adds Emmanuel Dartois, who is involved in another programme, Ice Age, whose PI is Melissa McClure (Netherlands). This programme focuses on the cold dust grains present in the molecular cloud during the star formation process, i.e. before the protoplanetary disk appears. *"With JWST spectroscopy, for example, we can remotely measure the size of the icy grains in the cloud."*

"Detecting this molecule in the interstellar environment was a real turning point, because we have long believed that CH_3^+ was the origin of many other hydrocarbon species."
— Marion Zannese

These grains may measure barely a micron, but the parameter is important. *"Grain growth changes many things within the molecular cloud, including in planet formation. This is the aim of our research, namely to determine the initial conditions so we can better understand the evolution to the next stages."* The entire history of stars and planetary systems in the Universe is being reconstructed brick by brick thanks to the JWST and its instruments. *"And this is just the beginning,"* concludes the researcher.

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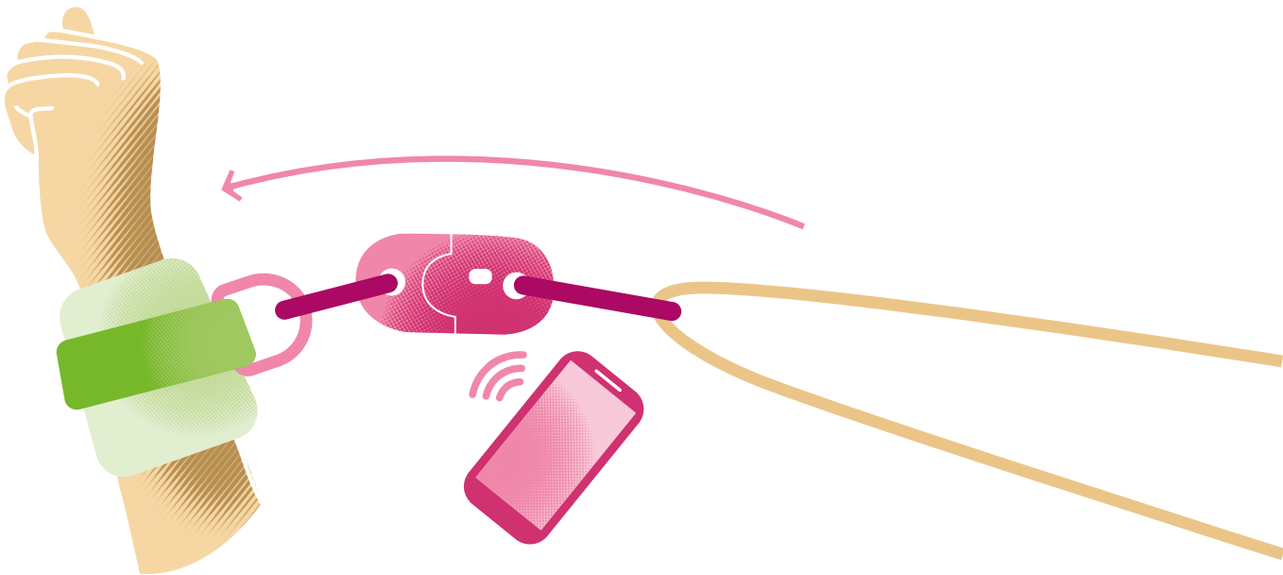
Innovating for better mobility

Start-ups revolutionise rehabilitation and mobility

As the Paris 2024 Olympic and Paralympic Games draw nearer, start-ups in the Université Paris-Saclay ecosystem are passionately committed to improving sports practice and performance, and rehabilitation for people with special needs. These start-ups work and collaborate with healthcare professionals, athletes and the sporting world to shape the future of sport and mobility, integrating cutting-edge scientific and technological methods. Below is a focus on three start-ups that have emerged from the University's laboratories and/or have been created by alumni.



Kinvent

Rehabilitation 2.0 for maximum motivation and performance

Founded seven years ago by CentraleSupélec alumnus Athanase Kollias, the Kinvent start-up specialises in physical therapy and biomechanics applied to sport. It helps rehabilitation and sports professionals boost their patients' motivation, and assess their rehabilitation progress with innovative movement-enhancing measurement and training devices.

"In my ten years of top-level sport, I spent more time with my physio than with my coach. But as I didn't find rehabilitation very interesting, I didn't go through with it," recalls Athanase Kollias, founder and CEO of the Kinvent start-up. The idea of creating Kinvent came to him from personal experience. Working closely with healthcare professionals and the sports ecosystem, the start-up now offers a range of instruments capable of motivating patients and encouraging them in their rehabilitation, tracking their progress and personalising rehabilitation and performance programmes.

"We've set up an application that connects to eight different sensors and enables a patient or an athlete to be assessed and trained for rehabilitation," explains Athanase Kollias. These sensors, connected to the application, are used to measure strength, balance and amplitude of movement as precisely as possible. The app provides real-time data to track patients' progress, with preset protocols and activities, such as exercises and video games, encouraging their ongoing engagement in rehabilitation. With this solution, Kinvent also targets top athletes, both in France and abroad, and forges partnerships with them, such as with French international footballer Raphaël Varane.

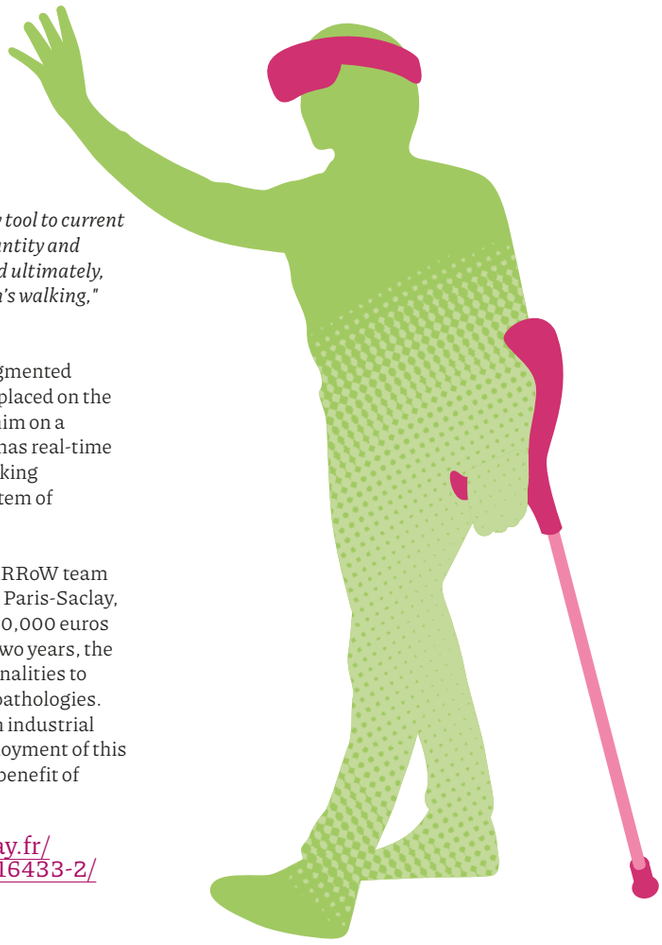
For Athanase Kollias, the support of the Paris-Saclay ecosystem, in particular CentraleSupélec and the IncubAlliance incubator, has been crucial to the development of his start-up. For almost a year and a half, IncubAlliance helped Kinvent structure its project and make its first contacts with the market.

After raising 16 million euros in early 2024, Kinvent is now preparing to enter the US market and has initiated an R&D project on machine learning. Thanks to this technology and its database, the start-up goes one step further in supporting physiotherapists by optimising rehabilitation programmes, providing the best treatment for each patient.

https://physio.kinvent.com/

ARRoW CP

Augmented reality for gait rehabilitation



The result of collaboration between the Computer Science, Bioinformatics and Complex Systems Laboratory (IBISC - Univ. Paris-Saclay/Univ. d'Évry) and the Ellen Poidatz Foundation, ARRoW CP is the first active augmented reality gait rehabilitation video game. It is designed to improve the walking ability of children with neurological motor disabilities.

The project started during physiotherapist Anne-Laure Guinet's thesis, supervised by Samir Otmane and Guillaume Bouyer, lecturers at the IBISC laboratory, and Éric Desailly, Director of the Ellen Poidatz Foundation's R&I Department.

The impetus for this research was the desire to improve gait rehabilitation practices, based on the needs and expectations of patients and therapists at the Ellen Poidatz Foundation. *"The ARRoW solution is a response to children's lack of long-term motivation for rehabilitation, and also to the difficulty therapists have in measuring children's progress,"* explains Samir Otmane. ARRoW is thus *"designed as a complementary tool to current treatment, to increase the quantity and intensity of rehabilitation, and ultimately, improve the quality of children's walking,"* explains the lecturer.

The device includes an augmented reality headset which, when placed on the young patient's head, takes him on a mobile adventure. The child has real-time information on his or her walking performance, thanks to a system of motivating rewards.

Since January 2024, the ARRoW team has been supported by SATT Paris-Saclay, which has invested nearly 400,000 euros in the project. Over the next two years, the aim is to develop new functionalities to extend the solution to other pathologies. The ultimate aim is to find an industrial partner to accelerate the deployment of this digital tool in France, for the benefit of patients.

https://satt-paris-saclay.fr/vitrine-technologique/16433-2/

MooveToi

Experience sport in a different way: when physical activity rhymes with accessibility and fun!

Founded in 2022 by Sterenn Poulhès, Alexandre Lamaison and Néva Béraud-Peigné, a PhD candidate at Université Paris-Saclay and part of the Complexity, Innovation, Motor and Sport Activities Laboratory (CIAMS - Univ. Paris-Saclay/Univ. d'Orléans) and the Sport and Health Science Institute in Paris (I3SP - Univ. Paris Cité), the MooveToi start-up aims to make physical activity accessible and fun for people with special needs: the elderly, the chronically ill, the disabled, and so on.

A basketball player at heart, Néva Béraud-Peigné was keen to offer her target group something different. *"We want to break away from conventional physical activity, especially for seniors. Instead of suggesting walking or yoga, we suggest basketball or boxing, but in an adapted way,"* explains the PhD candidate. All programmes are preceded and followed by physical and cognitive tests, to better adapt to each individual user. Each programme has different goals, such as preventing the risk of falls, stimulating cognitive functions, or improving a sense of competence and belonging.

Since it opened, the start-up has won several awards thanks to the Pépite PEIPS (Paris-Saclay Centre for Entrepreneurship and Innovation) inter-establishment student-entrepreneur diploma (D2E) that Néva obtained. And MooveToi's adventure is not about to end just yet. Winner of a Talents 2024 award to develop projects linked to the Paris 2024 Olympic and Paralympic Games, the start-up will be present this summer at several festive venues in the Paris region.

https://moovetoi.fr/

Muscle physiology

How it works, therapies and other mysteries

Numbering 639 in the entire human body, skeletal muscles are organs whose primary function is to contract. Made up of muscle fibres grouped together in fasciculi, muscles enable the human body to move or resist an external force. During contraction, the size of the muscle fibres decreases, and with it that of the fasciculus, and thus that of the muscle. How does this complex machinery work? What pathologies affect muscle cells and how can they be treated?

Keywords

Contraction

Adenosine triphosphate

Glucose

Creatine

Lactate

Muscle contraction begins with prior excitation of muscle fibres by motor neurons, at the interface between the muscle and the nervous system. This excitation causes muscle fibres to slide against each other, resulting in contraction and hardening of the muscle, and conversely, relaxation of the organ. At the heart of this complex mechanism lies an essential fuel: adenosine triphosphate (ATP), a nucleotide which, through hydrolysis, provides the energy needed for muscle cell contraction. ATP is synthesised through the aerobic system (using oxygen from the respiratory system), the anaerobic lactic system, or alactic system. The first two metabolic pathways consume glucose, while the last uses creatine during intense exercise.

In the anaerobic-lactic pathway, glucose (coming directly from muscle, blood or liver) is broken down into pyruvate: this is glycolysis. The pyruvate obtained is then the subject of a new chemical reaction leading to the formation of lactate. For a long time, lactate was labelled as a toxic waste product for muscle. It wasn't until 1986 and the work of George Brooks, a researcher at the University of California, Berkeley (USA), that lactate's role as a "shuttle" between different muscle sites was demonstrated. Lactate is mainly produced by fast-twitch muscle fibres and used as an energy substrate by slow-twitch fibres during contraction.

Unlocking the secret of exercise-induced metabolic abnormalities

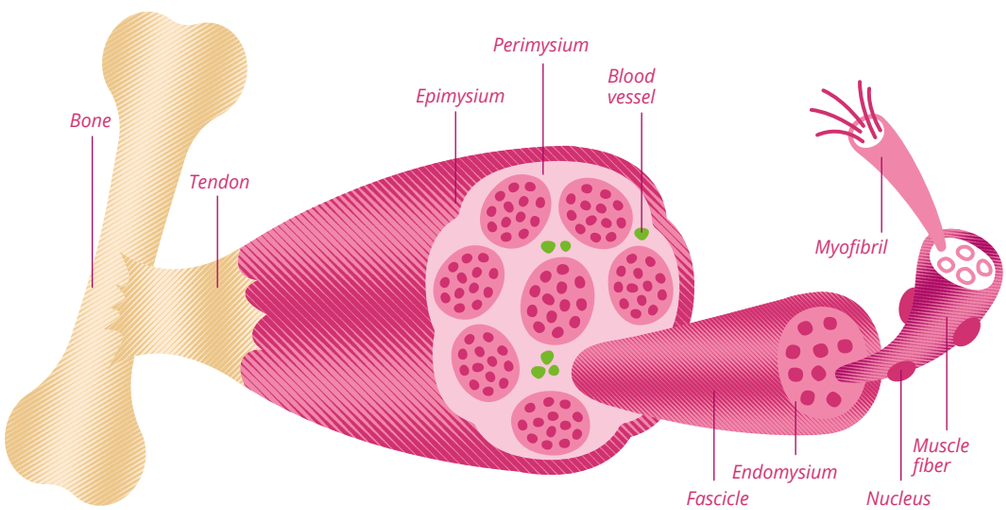
At the Exercise Biology for Performance and Health Laboratory (LBEPS – Univ. Paris-Saclay/Univ. d'Évry/French Defence Health Service), Claire Thomas-Junius is particularly interested in the anaerobic lactic pathway and the metabolic abnormalities caused by chemical reactions in this metabolic pathway. *"During intense exercise, the energy demand of muscles is met by the breakdown of carbohydrates. This process is accompanied by the production of lactate, an accumulation of inorganic phosphate and hydrogen ions (H^+), and a decrease in the concentration of bicarbonate ions in the body: metabolic acidosis occurs, a natural phenomenon resulting from the production of energy by the transformation of carbohydrates. My work involves understanding the effects of these metabolic disturbances on the organism and on the onset of fatigue,"* explains the researcher and director of the LBEPS. *"For a long time, the consensus was that lactate was toxic, that this molecule caused cramps. Yet the link between cramps and lactate has never been proven. The paradigm around lactate is changing. It is now considered to be an exerkine; exerkines are a group of molecules produced during exercise that have positive effects on muscle. What's more, lactate is a substrate that is recycled during exercise, saving the human body's glucose reserves,"* explains the researcher.

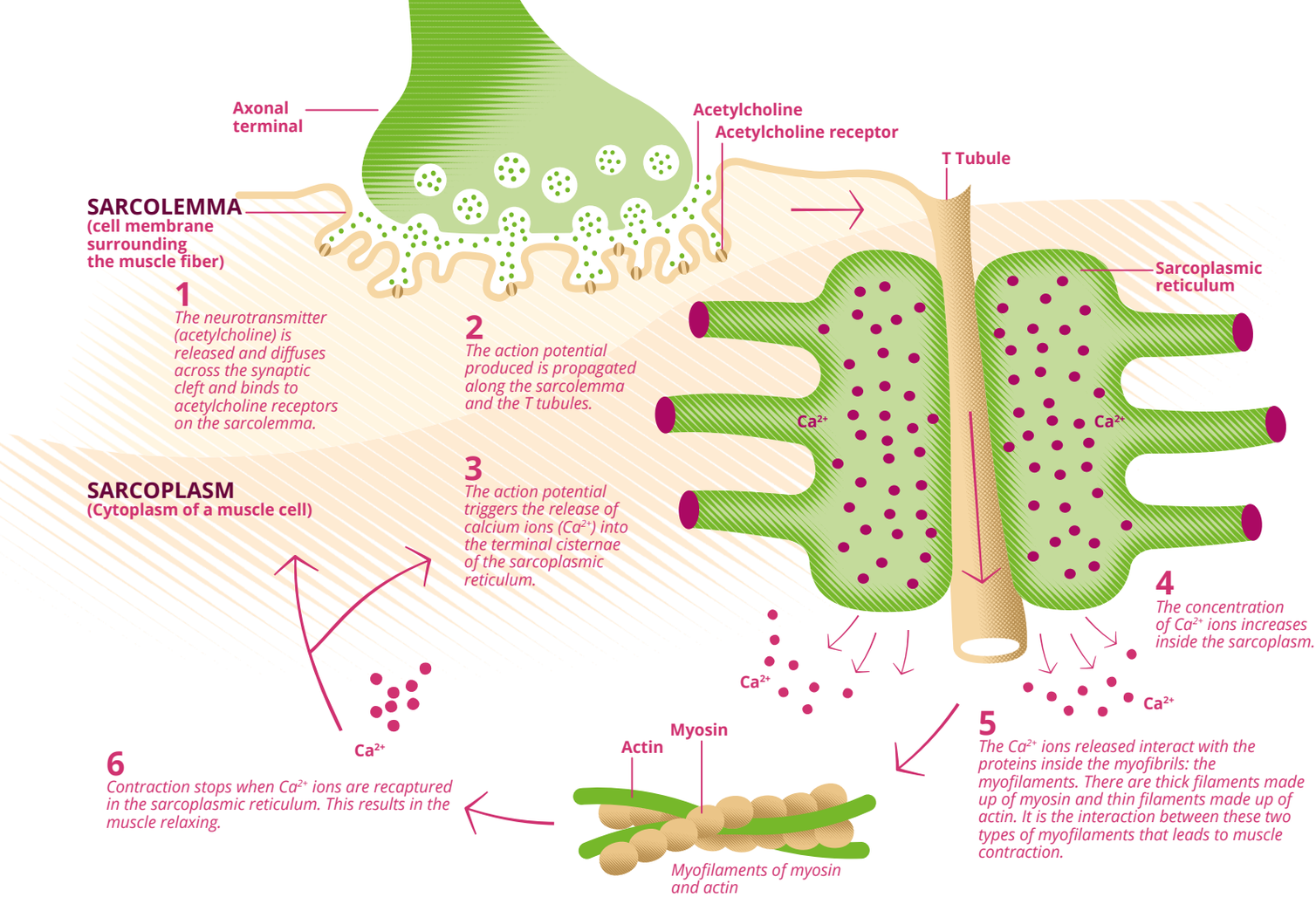
Metabolic acidosis, the immediate result of the breakdown of carbohydrates by muscle fibres, is a disorder of the acid-base balance that leads to a drop in pH. In particular, this imbalance has repercussions at the interface between the nerve ending and the muscle fibre, and thus on glycolysis. *"The energy produced by the breakdown of sugars will acidify the body,"* Claire Thomas-Junius explains. *"And when the muscle produces a lactate ion, due to its role as a 'shuttle', a proton is transported from the muscle to the bloodstream via a protein system. Finally, thanks to the production of lactate, muscle acidosis is limited."* A PhD thesis project launched in October 2023 at the LBEPS is currently focusing on the problem of muscle and adipose tissue communication and the fundamental role of lactates.

Applications of studies to elite athletes

A former middle-distance runner herself, Claire Thomas-Junius began her career as a researcher before joining Université d'Évry in 2005, focusing her research on high-intensity sports training, particularly with top-level athletes. In 2019, the researcher took part in the preparation of the book *Sports à haute intensité: mieux comprendre la performance pour mieux l'entraîner* (High-intensity sports: a better understanding of performance for better training), published by France's National Institute of Sport, Expertise, and Performance (INSEP). *"This book deals with high-intensity sports, based on the duration of effort, the type of effort required (continuous or intermittent) and how to adapt training to each effort, in order to plan specific training sessions for athletes or sedentary people,"* says the researcher. *"Because lactate production varies*

STRUCTURE OF A MUSCLE





TRANSMISSION OF THE NERVOUS SIGNAL AND MUSCLE CONTRACTION

depending on the intensity of the effort: the more intense the effort, the more the body will produce. Also, the more the effort is repeated, the greater the production. So, in a sense, lactate production is also trained."

In 2020, the researcher and her colleagues took part in tests focused on the French women's judo team, some of the best athletes in the world in their discipline, in preparation for major international competitions, and a year and a half before the Tokyo Olympic and Paralympic Games in 2021. Judokas were monitored after each training match, by collecting data on lactate, bicarbonate ion and blood acidity levels. The results obtained show a lactate concentration in the blood of the sportswomen that is around five times higher at the end of the series of four four-minute training sessions, at virtually the same pH. *"Thanks to this study, we were able to better understand metabolic responses to high-intensity exercise. These results justified an intensification of training sessions, while extending recovery times during each training session, a few weeks before the competition,"* explains Claire Thomas-Junius. Six medals at the World Championships and Junior World Championships immediately following this training, and three Olympic silver medals a few months later, make up these sportswomen's impressive list of achievements. *"There are many factors involved in performance,"* adds the researcher. *"Alongside physiology, there's obviously nutrition, psychology, sleep and so on."*

Alongside Claire Thomas-Junius, LBEPS PhD candidate François Chiron has recently been working on the effects of stress on sports performance, and on a case study in which he monitored a champion steeplechase runner. The results indicate that monitoring heart rate variations is an important indicator of the athlete's psychophysiological stress. *"Stress is reflected in numerous variations in heart rate. It should be noted that this heart rate is not entirely regular. The lower the variability of heart rate, the greater the stress on the body, and vice versa,"* explains Claire Thomas-Junius. Stress in the body leads to increased risk of injury, as well as impairment of important cognitive functions such as memory, learning or the functioning of hormone-producing neuroendocrine cells.

Claire Thomas-Junius and her colleagues also worked in partnership with the French Rowing Federation (FFA). *"The Federation's physical trainers were wondering what type of training to put in place, particularly with young athletes, to guide them towards the Paris 2024 Olympic Games and especially the 2028 Olympics. Should training be personalised for each case, or conversely, generalised for the whole Federation?"* says Claire Thomas-Junius. *"We finally realised that, depending on how far into puberty young people are, their metabolic and physiological responses are completely different, both in girls and boys. As a result, it was not advisable to give everyone the same training sessions. It's extremely interesting to incorporate this notion of biological age, based on puberty and its peak, instead of 'chronological' age,"* the researcher summarises.

This new paradigm is already inspiring junior competitions, where fairer rankings are starting to appear. *"The French Ski Federation (FFS) recently included a ranking of biological age rather than chronological age following a slalom competition. A young boy who would have finished 30th in the initial rankings ended up first in his category. This new calculation, based on the progress of their growth, is very rewarding for young sportsmen and sportswomen,"* says Claire Thomas-Junius.

At the same time, Claire Thomas-Junius and her team are also taking a close interest in the use of a new parameter to collect the information needed to monitor and assess the physiology of sportsmen and sportswomen: saliva. *"It's virtually non-invasive, and gives us access to information on stress levels, the state of the body, thanks in particular to the cortisone-testosterone ratio, the subjects' state of fitness, and so on,"* explains the director of the laboratory. Saliva samples were taken during the French Athletics Championships in summer 2023, and the results are currently being processed.

A career devoted to studying human endurance

Véronique Billat joined Université d'Évry in 1988, devoting her career to studying physical exercise and its physiology.

"My work focuses on understanding how to optimise energy according to each individual's physiological profile. At any age, I believe it's possible to improve aerobic energy by varying speeds, both in training and in competition," summarises the researcher, who has been monitoring track and field and marathon champions for several years. The scientist recently studied the differences in pacing strategy between two disciplines with very different environments: swimming and running. *"Depending on the technique and situation, whether swimming, running, cycling or even walking, the human body achieves the same maximum oxygen consumption (VO_2 max). However, the effort made will not be translated into the same running or swimming speeds, for example,"* Véronique Billat explains.

A university champion cross-country skier and runner, the researcher now helps both high-performance athletes and amateur sportsmen and sportswomen achieve their goals. In 2017, she supervised the training of 105-year-old Robert Marchand, before he set a world record for the distance cycled in one hour (over 22 kilometres).

Today, Véronique Billat is very interested in the animal model and in possible comparisons between human beings and animals. *"My idea is to compare, in an interdisciplinary way, animal and human models in real-life situations. I'm studying energy optimisation in a variety of environmental situations (altitude, temperature, etc.), trying to take into account the spontaneous reactions of animals,"* she explains.

Can physical exercise be a therapy for neuromuscular diseases?

Still at LBEPS, which he joined in 2021 as a winner of the Genopole Thematic Incentive Actions (Atiges) scheme, Olivier Biondi has been studying neuromuscular diseases and the innovative therapies that address them for over fifteen years. *"This encompasses therapies for diseases affecting the motor neuron, in the spinal cord or central nervous system, through to neuropathies, affecting the axons, the part of the neuron that conducts nerve information to the target cells. Myopathies, for example, damage the muscle,"* explains the researcher. *"Until now, I've mainly worked on two neurodegenerative diseases, which are very important in the world of sport."* The first, amyotrophic lateral sclerosis (ALS) or Charcot's disease, has a particular history with the world of sport: intensive physical exercise is considered to be a factor favouring the onset of the disease, the prevalence of which is greatly multiplied in high-performance sportsmen and sportswomen compared with the average for the general population. *"The other pathology is infantile-onset spinal muscular atrophy (SMA), which affects children,"* continues the biologist. *"I've always been interested in the effect of physical exercise on pathologies that more or less prohibit exercise: when you have motor neurone or muscle disorders, the medical recommendations are rarely physical exercise, for fear of aggravating the symptoms."*

The research that Olivier Biondi and his team are carrying out aims to combine physical exercise and therapy for neuromuscular diseases. *"The idea is to use exercise as a potential therapy, with daily patient management, and at the same time to use exercise as a means of highlighting faulty biological or cellular pathological mechanisms,"* says the researcher. *"My aim is to see to what extent physical exercise helps patients suffering from myopathies, and in particular muscular dystrophies, when muscle morphology is damaged,"* he summarises.

This raises the question of what type of physical exercise is best suited to each pathology. It's essential to match exercise sessions to the specific characteristics of each disease, as Olivier Biondi explains: *"If we take the example of Duchenne muscular dystrophy, a serious genetic disease affecting children that causes the rupture or alteration of the link between the muscle cell and the rest of the muscle, it's difficult to do physical exercise without pulling on this weakened structure and causing cell degradation. There are over 30 different dystrophies, all of which affect different genes and muscle cells in a different way. But using physical exercise, at intensities and with mechanical constraints adapted to each pathology, is always an option."*

Using animal and cellular models, Olivier Biondi and his team are seeking to determine the optimal conditions in which to do physical exercise for a specific disease, with the aim of stemming a vicious circle that can aggravate the sometimes paralysing symptoms of pathologies. *"As a result of reduced muscle function, patients take less exercise or even stop moving completely. And by moving less, muscles deteriorate even more,"* adds the biologist.

The most promising approach uses adeno-associated viruses (AAVs) as vectors carrying healthy genes to the targeted muscle fibres. Viruses are recombinant: they are produced from pieces of DNA to reduce or eliminate their toxicity to the subject. However, this practice is limited in several ways, as Olivier Biondi points out: *"First of all, to reach all muscles, it is now compulsory to use high-dose intravenous injections, i.e. to inject a very large quantity of virus, to try and reach as many muscles as possible. This is then a problem for the liver, as it threatens the functioning of the liver, a real 'virus sponge'. There's also a concern about heterogeneity: nowadays, despite the use of high-dose intravenous injections, it's difficult to target all the muscle fibres in the human body and in the same proportions."*

The aim of Olivier Biondi's team is to find ways of optimising the penetration of AAVs into muscles, as well as the expression of the genes introduced, in order ultimately to completely cure the disease and its symptoms. *"We believe that physical exercise offers great added value. Thanks to exercise, we have the capacity to change the proteins on the surface of muscle cells, and thus, why not, to facilitate access for AAVs,"* foresees the researcher.

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"As a result of reduced muscle function, patients take less exercise or even stop moving completely. And by moving less, muscles deteriorate even more." — Olivier Biondi

Combinatorial therapies as a solution to genetic neuromuscular pathologies?

While the use of physical exercise in the treatment of neuromuscular diseases would represent a step forward in the care of many patients, these therapies will never be curative. Alongside his studies on the contribution of physical exercise to therapies for neuromuscular diseases, Olivier Biondi is interested in the development of combinatorial methods, at the interface between genetics and the work of his team. *"We're working with Genethon, a laboratory specialising in gene therapy set up by the French Muscular Dystrophy Association (AFM) and based in Évry, on techniques to 'bring back' the healthy gene into the muscles of patients suffering from genetic neuromuscular pathologies – muscles which then contain a mutated gene at the origin of the disease,"* he explains.

Genome editing and agroecology

A combination that is proving beneficial

To cope with both rising food demand and climate change, agriculture needs to make the transition to agroecology. However, the selection of useful plants for the agroecological transition is based on different criteria, too often neglected in the past, as opposed to yield, long favoured in agriculture. The result today is a lack of genetic diversity in agricultural plants for these traits of interest. To re-establish variety on targeted genes and obtain plant species beneficial to the agroecological transition as quickly as possible, scientists are now using new genomic techniques, based in particular on CRISPR/Cas9 molecular scissors.

Agriculture in the 21st century faces the dual challenge of feeding an ever-growing world population, while at the same time standing up to the numerous challenges posed by climate change and other factors. To achieve this, today's agricultural system has to reinvent itself in order to continue producing while at the same time preserving natural resources. This is what agroecology is all about. In this new farming paradigm, the resources of biodiversity are used to reduce the employment of chemical inputs and avoid soil and water pollution. Plants are grown in association with other living beings: hedges, bacteria, fungi and service plants. The result is greater resistance to the various stresses to which the crop is subjected: bad weather, drought, pests and diseases.

Using genomics to produce plants with novel traits

Agroecology requires a detailed knowledge of the associations that can be made between plants and other organisms (such as other plants or soil bacteria). We also need to discover new associations. This requires a wide diversity of plants expressing a variety of different characteristics in terms of growth cycle, soil cover, weather resistance, and so on. And yet until now, agriculture has mainly selected plants for their yield, leading to low species diversity. *"Plants used in agriculture today are relatively poor in terms of the diversity of traits useful for agroecology,"* states Fabien Nogué, a researcher at the Jean-Pierre Bourgin Institute (IJPB - Université Paris-Saclay/AgroParisTech/INRAE). *"The agroecology prism thus brings in new goals, which are sought during the selection process."*

The characteristics expressed by a plant, such as its size, growth speed and leaf shape, are all encoded in its DNA. This long molecule, housed in the cell nucleus, has a double helix structure and is made up of a series of smaller molecules: nucleotides. Nucleotides are formed from four different bases: adenine (A), cytosine (C), guanine (G) or thymine (T). The sequence of these nucleotides forms a code, which is then translated by the cell to produce molecules fulfilling various functions: proteins. It is the expression of these proteins that gives the plant its apparent characteristics, the so-called phenotype.

The term "gene" refers to a segment of DNA that codes for a protein. The same gene exists in different versions, called "alleles". *"Alleles give rise to proteins with certain subtle differences, which confer different functions,"* says the researcher. For a given trait, different alleles result in different phenotypes. If we understand which gene is responsible for a particular trait, and if we are able to modify that gene, it then becomes possible to modify that trait in plants.

New, more natural genomic techniques

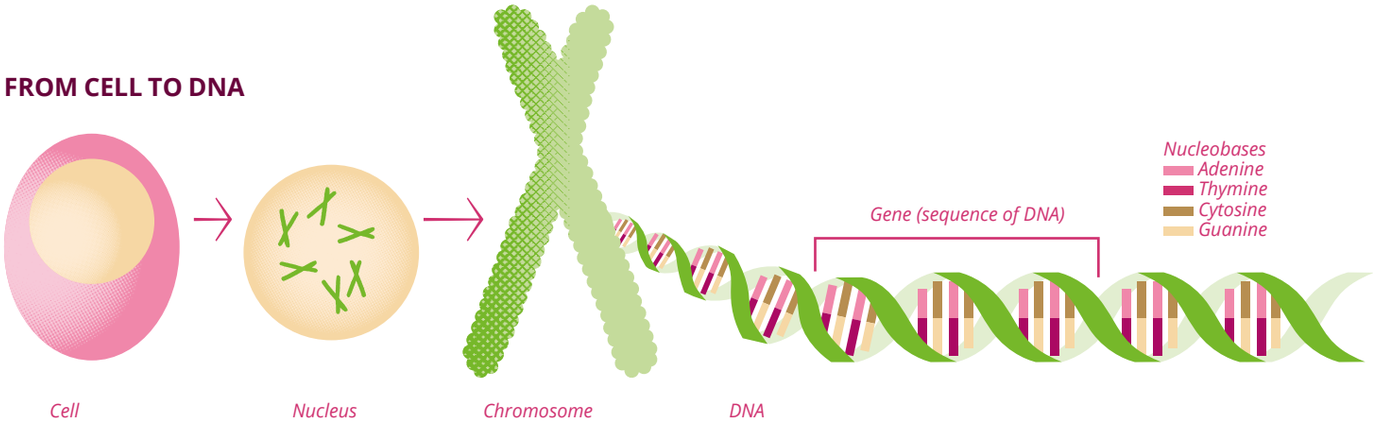
New genomic techniques (NGT) make this possible. These techniques are based on the use of "molecular scissors" such as the CRISPR-Cas9 system. *"This system is capable of generating a break in DNA at a given nucleotide sequence,"* explains Fabien Nogué. *"Cells have a molecular machinery capable of repairing this break. However, in some cases, this repair results in a modification of the DNA sequence"*: a mutation has occurred. By applying these techniques, we obtain an individual whose genome has been edited, resulting in a different expression of the targeted trait.

Similar to a genetically modified organism (GMO), i.e. an organism whose genetic make-up has been altered in order to acquire new properties, an NGT-modified organism is nevertheless different from a transgenic organism. Mutations obtained by NGT are indistinguishable from natural mutations, whereas so-called "conventional" (transgenic) GMOs are obtained by transferring a gene that may have originated in a different species. With NGTs, the only modifications made to the genome are deletions, insertions or the substitution of one or more nucleotides.

Keywords

Agroecology — DNA — Genome — New genomic techniques (NGT) — Molecular scissors

FROM CELL TO DNA



These mutations also occur naturally during cell division, or as a result of external factors such as exposure to the sun. Although these events are rare on the scale of the cell, they become commonplace when aggregated across all living organisms. *"We estimate that each base pair in the tomato genome is naturally mutated fifty times if we take into account all the tomatoes produced each year,"* says Fabien Nogué.

It is this process of mutation that results in the diversity of living organisms. By making it possible to carry out mutations similar to natural mutations, but targeting mutated genes, NGTs accelerate this diversification of living organisms on traits of interest. *"In some cases, NGTs are creating varieties that make sense in terms of reducing inputs"*, says the biologist, who was quick to seize on CRISPR-Cas9 technology for his research.

"When CRISPR-Cas9 came along, all of a sudden I had a tool that let me induce mutations at a chosen point in the genome. I then turned my attention to the possible applications of this tool. Together with colleagues, we have carried out NGT proofs of concept on various different species. For example, we have created a tomato variety that expresses the same resistance to a virus as a pepper," explains Fabien Nogué, who has also been an expert on the GMO panel of the European Food Safety Authority (EFSA) since 2015.

The virtues of the camelina-lentil combination

Jean-Denis Faure, also a researcher at the IJPB and professor at AgroParisTech, is also working on plant varieties for agroecology. This professor of physiology devotes his work to the camelina, a plant cultivated in Europe up until the early 20th century, and which is now attracting renewed interest as part of an agroecological transition. *"It's a plant that tolerates various different stresses, and its short cycle means it can be grown in a variety of different conditions. What's more, it has a particularly rigid bearing,"* explains the scientist. This particular trait is of interest for other plants with a more flexible habit, such as lentils.

"NGTs shouldn't be seen as a panacea. These techniques are not the death knell of conventional selection." — Fabien Nogué.

"If there are heavy showers, the lentils are washed onto the ground. It is then vulnerable to fungus and rot." A few camelina plants in a lentil field act as stakes, making the crop more resistant to bad weather.

The combination of lentils and camelina could be even more advantageous. *"Lentils are often attacked by bruchids. These tiny insects bore into the seeds, making them unusable. This is a real problem in Protected Designations of Origin (PDOs), where the choice of varieties grown is limited. Camelina, like cabbage-type plants, emits volatile sulphur molecules, which are insect repellents,"* explains Jean-Denis Faure, who plans to study this plant association in greater depth.

According to this researcher, virtuous exchanges also occur in the other direction. Lentils are in fact a legume. This family of plants has the ability to capture nitrogen through symbiosis with bacteria. Nitrogen is essential for plant growth, as it is a component of protein amino acids. *"Lentils could provide camelina with some nitrogen, resulting in an extremely virtuous system,"* says Jean-Denis Faure. The nitrogen provided by lentils would at least partially replace artificial fertilizers.

NGTs to reduce inputs while preserving profitability

According to Fabien Nogué, the combination of nitrogen-capturing legumes with plants of interest is being considered in many other cases, notably with wheat and corn. *"The difficulty at the moment is that legumes and wheat or corn grow differently and therefore have different harvest times."* Up to now, harvesting time was not one of the criteria selected for legumes. But with NGTs, researchers hope to obtain varieties whose growth is compatible with wheat or corn cultivation.

"The idea is that combining plants should be just as profitable for the farmer as monoculture," Fabien Nogué emphasises.

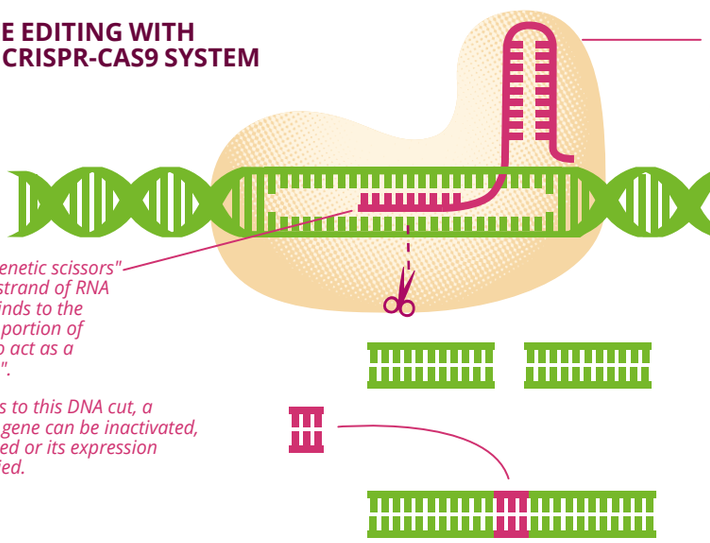
To encourage farmers to diversify their crops, scientists are also working on diversity of use. Due to lower yields, camelina, for example, is not as economically attractive today as other intensively cultivated species such as rapeseed. However, *"the first thing a farmer looks at when choosing a species to grow is whether he get value from it,"* explains Jean-Denis Faure. To overcome this obstacle, the IJPB researcher focuses on using NGTs to drive the plant to express new traits, for example by modifying the nature of the oil produced so that it finds new uses.

Another goal of agroecology is to reduce the use of herbicides. One of the strategies envisaged is the use of more covering plants that develop a vegetation cover in the early stages of their growth, thereby limiting weed growth. This strategy requires plant varieties that produce broad basal leaves as soon as they germinate. But then again, *"these are not characteristics that have been worked on to date. Current varieties don't meet these needs,"* points out Fabien Nogué. Hence the interest of NGTs in restoring diversity to traits that have disappeared or have not yet been worked on.

More scientific challenges

However, *"NGTs shouldn't be seen as a panacea,"* says Fabien Nogué. *"These techniques are not the death knell of conventional selection."* Their main limitation lies in the fact that, without detailed knowledge of the genes encoding each trait, genome editing cannot be used to give the plant a specific trait. For example, not all the genes responsible for symbiosis between legumes and nitrogen-fixing soil bacteria have been identified yet. *"We can't explain this phenomenon by naming ten important genes and the order in which they are expressed,"* says the researcher. We'll have to wait a little longer before we can obtain new plant species capable of this symbiosis as quickly as we would wish.

GENE EDITING WITH THE CRISPR-CAS9 SYSTEM



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Co-design

A new scientific method?

Despite the power of new genome-editing techniques (NGTs), their relevance to agroecological transitions remains open to debate. In order to develop innovations that best meet the challenges of these transitions, scientists are experimenting with a new way of managing their research: co-design. This involves working together across disciplines and with a variety of different players to build up research issues that best take into account the needs of the different stakeholders.

While genome editing is a powerful tool that can be mobilised to support the agroecological transition, experience with GMOs calls for a certain caution when it comes to the promises made on behalf of NGTs. Firstly, it is highly likely that such technologies alone will not solve the world's hunger problems. Secondly, the real capacity of GMOs to reduce the inputs (fertilizers, pesticides, etc.) used in agriculture remains controversial. As a result, the scientific community is wondering how to position itself on such research topics while driving sustainable progress.

To respond to major and complex societal challenges in a wide variety of fields, such as hunger and the preservation of biodiversity, academic research is increasingly adopting a new modus operandi: co-design. Researchers are often experts in one particular field of research, working on issues at the cutting edge of that field - enabling progress towards ever richer and more solidly established knowledge. However, this usual mode of operation in academic research comes up against certain limits when it comes to proposing solutions to problems that combine very different aspects.

Co-design provides a striking contrast to this. A research project is usually defined in advance, with a precise problem to which it seeks to respond; resources are then allocated for a certain duration, and at the end of the project, the participants all meet to take stock of the initial question. Co-design, however, overturns this established order - the research question is not defined beforehand and the project begins with the various players.

Genetics and agronomy: bringing together distant scientific interests through co-design

As part of the France 2030 research programme "Advanced Plant Science for Climate Change and Agroecological Transition" (SVA in French), Jean-Denis Faure, a researcher at the Jean-Pierre Bourgin Institute (IJPB - Université Paris-Saclay/AgroParisTech/INRAE), is responsible for defining strategies for an agroecological transition based on genome editing. Such a project requires the involvement of a wide range of specialists, not just geneticists, but also agronomists specialising in agroecology. But given the differing concerns of all these research communities, defining a common research project to rally around can sometimes prove difficult.

"This is particularly true when we try to combine genetics and agroecology," concedes Julie Labatut, a researcher in Management sciences at the Animal Genetics and Integrative Biology laboratory (GABI - Univ. Paris-Saclay/INRAE/AgroParisTech) with which Jean-Denis Faure is currently collaborating. *"Geneticists and agronomists are opposed in their methods, their goals and their visions of innovation."* Agronomy focuses on farmers' practices and on interactions between farms at the territorial level, i.e. on a macroscopic scale, whereas genetics is concerned with the microscopic. *"After a year and a half's work, I hadn't come up with a satisfactory project,"* confides Jean-Denis Faure. Today, with Julie Labatut and other scientists from different disciplines, he is working to set up a co-design process as part of the SVA programme.

Applying a management science method

This work will take place over several years. The first year will be devoted to defining a common research question. *"We plan to bring together around thirty participants over several days, using the Knowledge, Concepts, Propositions (KCP) method,"* explains Julie Labatut. This method was designed for companies looking to innovate, although for several years now, Julie Labatut has been applying it to agricultural issues.

In the first phase of the KCP method, people share their knowledge. They then generate new concepts based on this shared knowledge. The final step in the KCP method is to write down proposals based on these concepts. The proposals form the research question on which the project will focus. This method aims to widen the field of possibilities by helping to co-design new research issues.

It was in the Basque Country that Julie Labatut first applied the KCP method to an agricultural problem. The black head Manech sheep, a breed of ewe whose milk is used to make Ossau-Iraty cheese, was competing with more productive breeds of sheep. Using the KCP method, the researcher brought together breeders unfamiliar with genetic selection and geneticists unfamiliar with the importance of the shape of a ewe's horns. *"Over a period of ten years we brought together people who had never spoken to each other before, to develop an innovative breeding programme,"* says Julie Labatut.

Towards a redefinition of scientific goals for innovation closer to the challenges of sustainability

Will co-design make it possible to combine state-of-the-art genetics and agroecology? According to Julie Labatut and Jean-Denis Faure, this will also require a change in the definition of scientific goals. *"We need to move from an economy of promise to an economy of impact,"* confides the researcher. This means developing methods and criteria for evaluating innovation coming out of the laboratories in real time, rather than promising new, better-performing plant varieties.

Understanding the real interest of a new plant species for farmers, and its impact on the agroecological transition, is a whole research project in itself. Its impact on the environment is very diverse, and its behaviour in the field is sometimes very different from in the laboratory. *"The socio-economic impact, in terms of innovation governance, socio-technical barriers and long-term benefits, has to be assessed along the way,"* emphasises Julie Labatut.

To ensure that genome editing and agroecology progress hand in hand, scientists in the SVA programme will be mobilising co-design approaches and real-time socio-economic impact analysis right from the start of their research. Researchers will thus ensure that their work is as close as possible to the real needs of the different farmers and the challenges of agroecological transition. The hope is that this innovation will eventually leave the laboratory and be applied in the field.

Keywords

Co-design

Innovation

KCP method

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International press

The New York Times

Scanning the Dark Universe, Euclid Finds Scenes of Cosmic Light

Euclid, a European Space Agency telescope launched into space last summer, finally showed off what it's capable of with a batch of breathtaking images and early science results recently released. The telescope will help astronomers make sense of two of the universe's greatest mysteries: dark matter, the invisible glue clumping galaxies together, and dark energy, the force pushing them apart.

https://www.nytimes.com/2024/05/23/science/euclid-telescope-images.html

PHYS.ORG

Reinterpreting the Higgs mechanism: Decay and fission of 'magnetic quivers' could clarify quantum structures

An international research team led by Marcus Sperling, a project leader at the Faculty of Physics, University of Vienna, and Antoine Bourget of Université Paris-Saclay, has sparked interest in the scientific community with pioneering results in quantum physics. In their current study, the researchers reinterpret the Higgs mechanism, which gives elementary particles mass and triggers phase transitions, using the concept of magnetic quivers.

https://phys.org/news/2024-06-reinterpreting-higgs-mechanism-decay-fission.html

europa press

Webb permite cartografiar en profundidad la Nebulosa de Orion

Un consorcio internacional de 120 científicos apuntó el telescopio espacial Webb hacia la Barra de Orión, en lo profundo de la Nebulosa de Orión, y recopiló un tesoro de imágenes y datos espectroscópicos.

https://www.europapress.es/ciencia/astronomia/noticia-webb-permite-cartografiar-profundidad-nebulosa-orion-20240521131812.html

CORRIERE DELLA SERA

Problemi respiratori nei neonati: una nuova tecnica consente di personalizzare l'assistenza (anche a distanza)

Pubblicato su Jama Network uno studio internazionale multicentrico, coordinato dal prof. Daniele De Luca, Università Parigi Saclay. L'uso dell'ecografia polmonare quantitativa permette di capire se un neonato si aggraverà. Possibile pure una valutazione in telemedicina.

https://www.corriere.it/salute/24_maggio_29/problemi-respiratori-nei-neonati-una-nuova-tecnica-consente-di-personalizzare-l-assistenza-anche-a-distanza-61e6c6c6-fcea-4cd2-a006-d2dca0171xlk.shtml

INDEPENDENT

Brazil's Rio Grande do Sul faces economic woes after floods, and an unclear path to rebuilding

Flooding in Brazil's Rio Grande do Sul state ravaged nearly everything needed for economic activity, from local shops to factories, farms and ranches. The environmental catastrophe — unprecedented in state history — upended transportation, including the airport in the capital Porto Alegre, which is expected to remain shuttered for months. Segments of major highways are closed due to landslides, washed-out roads and collapsed bridges. Blackouts continue to plague the state.

https://www.independent.co.uk/news/world/europe/brazil-ap-rio-grande-gdp-rio-de-janeiro-b2550543.html

University World News

Good practices in sustainability education from top universities

As universities the world over grapple with how best to integrate sustainability concerns into curricula and operations, the League of European Research Universities (LERU) has released a detailed report offering good practice examples of education for sustainable development from its 24 elite university members.

https://www.universityworldnews.com/post.php?story=20240327174821749

EUGLOH on the move

Connected walking challenges for the European alliance

To mark the Olympic year, Université Paris-Saclay, which coordinates the EUGLOH European Alliance, has organised three connected walking challenges using a mobile app. From January to June 2024, more than 300 male and female players from the Alliance's nine universities took part in these challenges, covering a combined total of more than 40,000 kilometres.

One hundred years after they first came to the city, the Olympic Games are back in Paris. And the European University Alliance for Global Health (EUGLOH) is determined to make its mark. What better way, then, than to encourage everyone to get involved in some physical activity? This is the aim of the connected walking challenges that Université Paris-Saclay organised for EUGLOH, running from January to June 2024. *"As well as marking the Olympic year, the idea was to promote regular, moderate physical activity, such as walking, across the nine universities in the Alliance,"* explains Macarena Furque, EUGLOH Communication Officer & Campus Life Co-Manager at the University's Department for International and European Relations (DRIE).

Open to the student community and all staff of the nine EUGLOH member universities, the initiative included three sessions lasting a few weeks each. To take part, all you had to do was download the Kiplin mobile app, which specialises in monitoring physical activity, then log in to join the EUGLOH2024 initiative. Participants then had to form teams of up to five players to complete the three sessions.

At each session, competitors' steps were counted every day for the chance to win trophies. Reaching 50% of your daily step goal was equivalent to one trophy, 100% to three trophies. Most of the participants succeeded with flying colours. By the end of the first session alone, the 62 teams registered had covered a total of no less than 17,600 kilometres, the equivalent of more than 20 journeys between Paris and Marseille.

"As well as marking the Olympic year, the idea was to promote regular, moderate physical activity, such as walking, across the nine universities in the Alliance." — Macarena Furque

Walking and quizzes collective

The challenges weren't just about walking. During each session, participants also had to answer questions prepared by the project's initiator, Caroline Teulier, a lecturer at the Faculty of Sports Sciences attached to the Complexity, Innovation, Motor and Sports Activities Laboratory (CIAMS – Univ. Paris-Saclay/Univ. Orléans) and Charlotte Malle, a Master's student in Training and Optimisation of Sports Performance at the University.

The first session, entitled "EUGLOH on the move", featured a quiz on the EUGLOH Alliance and the prevention of health issues through physical activity. One of the questions asked, for example, concerned the recommended 150 minutes of physical activity per week for an adult. For each correct answer, the teams collected new trophies. With these challenges, *"we wanted to promote walking, but also to teach people about the health benefits of physical activity,"* explains Macarena Furque.

The same was true of the next two sessions, "Walking through EUGLOH" and "EUGLOH at the Olympics", which asked players about cycling and the Paralympic Games, in a nod to this summer's event, which France will be hosting for the very first time.

It's off to the Paralympics for the winning students collective

A score logically implies a winner, and one winning team was chosen for each session. But students from the Alliance's universities who took part in the three sessions were also competing for a bigger prize: a three-day event co-created with the University of Novi Sad (Serbia), to be held next September at Université Paris-Saclay.

Centred on the theme of accessibility to physical activity on the campuses of the Alliance's universities, the programme includes, for the ten prize-winners, the opportunity to attend some of the events of the Paris 2024 Paralympic Games, which will come to a close on 8 September.

https://www.eugloh.eu/

Disabled sport

Awareness-raising workshops to try your hand at blind football and boccia

While 2024 stands out in France for the organisation of the Olympic and Paralympic Games in Paris, the year also promises to leave its mark on sports at Université Paris-Saclay. In January and March, disabled sport awareness workshops were held at the Moulon University Omnisport Centre and at the Kremlin-Bicêtre Faculty of Medicine. This is an opportunity for the University to reinforce its commitment to the inclusion of all, and to further raise awareness of disability among its students.

2024 not only marks the return of the Olympic Games to Paris, a century after the 1924 Games; it is also France's first-ever hosting of the Paralympic Summer Games, which include competitions in blind football and boccia. *"It was an opportunity we just had to take,"* explains Gwennaël Pacé, Head of Diversity and Disability at Université Paris-Saclay. *"It is an opportunity to showcase sporting disciplines open to people with disabilities,"* and to take advantage of the Paralympic Games this summer.

Last March, some fifty participants tried their hand at blind football on the Kremlin-Bicêtre Faculty of Medicine campus, as part of an awareness-raising workshop organised by the University's Diversity and Disability Department. Blind football is one of the 22 sports that will be present at the Paris Paralympic Games, from 28 August to 8 September 2024.

The discipline is designed for the visually impaired and blind, who compete against each other, with the ball at their feet, in two halves of fifteen minutes each. Each team is made up of four outfield players and a goalkeeper, all of whom wear masks covering their eyes to ensure fairness among all participants. All they have to rely on is their perception of space and sound to play and find their way around. On the pitch, disabled players have to shout "voy" when they go for the ball; this means the people watching have to be very quiet.

Through awareness-raising workshops organised at Université Paris-Saclay, participants were also introduced to another Paralympic sport: boccia. First introduced at the 1984 Chicago Paralympic Games, this discipline is for players with reduced mobility or cerebral motor skills. Similar to pétanque, it can be played individually, in pairs or groups of three. Competitions are divided into four or six rounds, in which players throw six balls to get as close as possible to the white ball, known as the jack.

> *"I didn't realise how difficult it is to play with a ball when you can't see anything at all."* — a student of Faculty of Medicine of Université Paris-Saclay

Collective awareness

What blind football and boccia have in common is that they are open to all, and can be played by able-bodied people under the same conditions as disabled players. This is what motivated Gwennaël Pacé to organise these workshops, in partnership with the association ODAAS (*Organisation diversification autour d'actions de sensibilisation* in French, meaning Organising Diversification by means of Awareness Actions), which works to combat prejudice against people with disabilities.

© Christophe Peus

© Christophe Peus

As well as introducing these sports to the public, the aim of the workshops is to raise awareness of the difficulties that sporting activities hold for people with disabilities. For many of the students who took part, the experience paid off. *"I didn't realise how difficult it is to play with a ball when you can't see anything at all,"* says a student from the Faculty of Kremlin-Bicêtre who tried his hand at blind football. *"I really admire the skills of these players."*

Taking advantage of workshops to talk about disability support

For the University's Handicap and Studies Service (SHE in French), the event was also an opportunity to make itself known to students who could benefit from its support if they have a temporary or permanent motor, sensory or psychological disability. Through these initiatives, Gwennaël Pacé hopes to encourage exchange based on actions in favour of inclusion, in a context conducive to dialogue and togetherness.

The success of previous workshops convinced the SHE team to repeat the experience: *"We've already planned three blind football and boccia workshops for the coming academic year, and we would like to tour the campuses,"* she explains. *"Ghislain Rémy, in charge of disability at Université Paris-Saclay, will even be teaching chanbara [a Japanese martial art using foam weapons] once a week from the start of the new academic year."*

More than ever, sport is showing its ability to bring people together, and also to take the time to listen to each other, in a spirit of respect and understanding.

Heritage

Works of art on Université Paris-Saclay campuses

Boasting 40 pieces from the 1% artistic fund belonging to its member institutions, Université Paris-Saclay also houses sculptures and paintings on loan from the Centre Pompidou, the *Centre national des arts plastiques* (Cnap, meaning National Centre for the Visual Arts) and the Essonne Departmental Contemporary Art Fund (FDAC). All these works of art, often by internationally renowned artists from the 20th and 21st centuries, constitute remarkable heritage, visible and accessible to all.

As you stroll through the various campuses of Université Paris-Saclay, it is not uncommon to come across a monumental sculpture, installation, fresco or tapestry that catches the eye and the interest of passers-by. These works of art are part of the University's artistic heritage, a large part of which comes from the 1% artistic fund. This legal provision, in force in France since 1951 and extended to universities in 1993, requires all public buildings under construction or renovation to devote 1% of their budget to the commissioning of a work of art by a living artist. In addition to supporting creative work, the aim of the 1% artistic fund is to share contemporary art with all citizens, beyond the regular museum-goers. At Université Paris-Saclay, this system brings art into the everyday life of the entire university community.

1% for the arts brings art to the campus

As part of the 1% artistic fund, a work of art is commissioned as soon as the building is constructed, via a call for tenders to which artists of all profiles can respond. All they have to do is design a work of art that will blend in with the architecture of the building in question. A jury, made up of representatives of the presidency and the building in question, the architect of the commissioning institution and specialists appointed by the Regional Directorate of Cultural Affairs (DRAC in French) and the university, then evaluates the artistic ideas submitted. Once the choice has been made and the order released, the artist chosen is responsible for creating the piece.

Forty works of art from this programme can now be found on the University's different campuses. The oldest date back to early 1955 and the most recent to 2020. The list even includes internationally renowned artists such as Germaine Richier, Alfred Janniot, Robert Couturier, Gérard Fromanger and Jean-Marie Appriou.

With the 1% artistic fund, the university is committed not only to financing works of art, but also to maintaining them and guaranteeing them good exhibition conditions. *"Our role is to maintain and enrich the university's heritage,"* confirms Patrice Godard, in charge of preserving and promoting cultural heritage at Université Paris-Saclay. In 2019, a sculpture by artist Paul Belmondo, depicting Apollo, was renovated thanks to the budget allocated, and unveiled in the presence of his son.

> In addition to supporting creative work, the aim of the 1% artistic fund is to share contemporary art with all citizens, beyond the regular museum-goers.

While some component institutions of Université Paris-Saclay have acquired works of art in recent years thanks to the 1% artistic fund, such as ENS Paris-Saclay in 2020, no call for projects has been launched since 1973 within the employer perimeter. This was achieved in 2023 by means of two different campaigns, one for the H-Bar building on the Orsay campus, the other for the Pascal building on the Moulon plateau. Discussions on the choice of the two works of art to be housed in these buildings are still in progress and nearing completion.

Some artists, or their heirs, decide to donate their works to the University. Such is the case for Jean Suzanne, whose monumental sculpture donated to the University will be installed in June 2024 at the Solid State Physics Laboratory (LPS - Univ. Paris-Saclay/CNRS) on the Orsay campus. Donations of other monumental sculptures by Albert Féraud, Michel Charpentier, René Coutelle and Claude Mercier are expected to follow. *"These are often the children of artists who want their parent's work to be showcased through an installation at the University,"* explains Patrice Godard.

> Thanks to a new artistic policy, renowned street artists such as Muziotti, Turk and Twopy are invited to express themselves on the walls of University buildings.

Heritage enriched by prestigious collaborations

In addition to the pieces acquired as part of the 1% artistic fund, Université Paris-Saclay is a partner of numerous prestigious institutions that enrich its artistic heritage. The Molecular Science Institute of Orsay (ISMO-Univ. Paris-Saclay/CNRS) holds sixteen prints by various different painters, as well as a monumental sculpture - *Gorgone* - by Vincent Barré. These pieces come from the collections of the *Centre national des arts plastiques* (Cnap), which has been collaborating with the University for several years now. Since 2023, the Henri Moissan site on the Saclay plateau, home to the Biology - Physics - Chemistry cluster, has benefited from a loan from the Centre Pompidou, consisting of the piece *Algebrica* by Antoine Poncet, a leading figure in abstract sculpture in the late 20th century.

Street art at the University

Over the past few years, street art has become increasingly popular on the streets and alleys of university campuses. Thanks to a new artistic policy, renowned street artists such as Muziotti, Turk and Twopy are invited to express themselves on the walls of University buildings. Urban artist Christian Guémy, better known as C215, has painted large portraits of scientists and science fiction characters on the interior and exterior walls of CEA Paris-Saclay buildings. This initiative more closely links art and science, two creative processes that are all too often pitted against each other.

Some pieces from the 1% artistic fund

Terra Mater by Alfred Janniot (1963)

Alfred Janniot (1889 - 1969) was a French sculptor and leader of the Art Deco movement, best known for his bas-reliefs on the Palais de la Porte Dorée and the Palais de Tokyo in Paris. In 1963, he created a dreamlike, monumental sculpture for what was then the Orsay Centre of the Paris Faculty of Science. Located in front of building 302 on the Vallée campus in Orsay, this female figure, with an owl and a python on her head and adorned with lush flora and fauna, represents the primordial goddess Gaia, ancestor of deities and monsters. It blends in perfectly with the rich vegetation of the surroundings. Over time, this fantastic, metaphorical creation became a symbol of Université Paris-Sud and now of Université Paris-Saclay.

Terra Mater © *Christophe Peus*

Two out of the four tapestries : Soleil et sable *and* Optique et lyophilisation © *Christophe Peus*

Dans le jardin © *Tanguy Beurdeley*

Four tapestries (1973) : *Comme une musique* (Michel Seuphor), *Optique et lyophilisation* (Jacques Despierre), *Soleil et sable* (Gustave Singier), *Torse rouge étendu* (Raoul Ubac)

In 1973, four artists created four imposing tapestries for the Faculty of Pharmacy of Université Paris-Sud (now Université Paris-Saclay), at the time located in Châtenay-Malabry. All the same size, they are typical of the abstract movement of the 1970s, but with very different styles. In *Torse rouge étendu* (Red torso stretched out), Raoul Ubac evokes the rhythm of ploughing in the fields, using furrows against a solid red background. In *Comme une musique* (Like a piece of music), Michel Seuphor makes white lines dance against a background of parallel black lines, evoking musical notes. Gustave Singier uses linear projections and flat tints of warm colours, recalling the title of the work *Soleil et sabl*e (Sun and sand). Finally, Jacques Despierre gives us a highly dynamic composition in *Optique et lyophilisation* (Optics and freeze-drying), in which geometric shapes intertwine in black and white. When the Faculty of Pharmacy of Université Paris-Saclay moved to the Plateau de Saclay in September 2022, it proved impossible to keep these works of art. The University donated them to the University of Évry, which now exhibits them in the hall of its Maupertuis building. As well as illustrating the collaboration between members of Université Paris-Saclay, this transfer of works of art shows that cultural assets are preserved beyond the life of the building in which they were created.

Dans le jardin by Jean-Marie Appriou (2020)

Ahead of its move to the Plateau de Saclay in 2020, and as part of the construction of its new building, ENS Paris-Saclay, previously located in Cachan, launched several calls for proposals under the 1% artistic fund. The 38-year-old French sculptor Jean-Marie Appriou was commissioned to create an ensemble, which today adorns the ponds in the school's inner garden. Bats and giant dragonflies fly over two basins, while an island of cypresses and a clump of brambles are planted in two others. Finally, in the central basin is a dugout canoe with an oarsman and a seahorse-skin figure. Often inspired by myths and legends, here the artist evokes the cycle of the sun in these east-west oriented basins.

Calendar

Place Host

Summer/Autumn 2024

We were there

MAY

Parc des expositions,
Porte de Versailles, Paris
Publicis Groupe, Les Echos

22 → 25 may

Viva Technology 2024

Université Paris-Saclay, the only university in France to have had a stand at Viva Technology 2024, the biggest event dedicated to innovation in Europe, took the opportunity to present 21 of its start-ups coming from its environment and its partners, around four topics (artificial intelligence, physics, health, sustainable development).
https://www.universite-paris-saclay.fr/en/news/universite-paris-saclay-and-its-partners-viva-technology-2024

Not to be missed

JUNE

Lumen - Université Paris-Saclay, Gif-sur-Yvette
Université Paris-Saclay

3 june → 18 september

Exhibition

À la limite - Innover à la mesure du monde, 2055 (On the edge - Innovating to fit the world, 2055)

This exhibition is taking visitors on a journey through time to the year 2055, encouraging them to think about the place of innovation in a world bound by planetary limits, along a path inspired by works of science fiction and featuring a series of entertaining and interactive displays.
https://www.lumen.universite-paris-saclay.fr/evenements/la-limite-innover-la-limite-du-monde-2055

JULY

Orsay, Palaiseau and Saclay campuses
Irène-Joliot Curie - Physics of the Two Infinities Laboratory (IJCLab – Univ. Paris-Saclay/CNRS/Univ. Paris-Cité)

1er → 11 july

Summer meeting

From the infinitely large to the infinitely small

For its 12th edition, this event is inviting around thirty students of 3rd-year undergraduate degree or equivalent level to two weeks of courses, laboratory visits, experiments and debates on physics from the infinitely large to the infinitely small, from the cosmos to elementary particles, including the first moments of the Universe.
https://indico.in2p3.fr/event/32397/overview

Université d'Évry
Université d'Évry, Exercise Biology for Performance and Health Laboratory (LBEPS – Univ. Paris-Saclay/Univ. Évry/French Armed Forces Health Service), Genopole

2 july

Conference

Optimising innovative therapies

Now in its third edition, this conference will focus on innovative and combinatorial therapies, and explore ways of optimising these therapies by improving their addressing and their targeting with the goal of achieving more specific effects and more effective approaches to treating pathologies.
https://www.genopole.fr/temps-forts/agenda/conf-therapies-combinatoires3/

Parc Charles Boucher, Orsay
La Diagonale Université Paris-Saclay, Orsay city council, Youth and Culture Center Jacques Tati, Essonne Departmental Conservatory (CRD)

6 july

Festival

From the big bang to big bands

The festival From the big bang to big bands, which is devoted to astrophysics, music and film, is back for a fourth edition. From afternoon to night, the event will offer a full programme of workshops, mini-conferences, musical sets, open-air cinema, swing ball and telescope observations.
www.dubigbangauxbigbands.fr

ENS Paris-Saclay
Inria and Maison du doctorat (Université Paris-Saclay Innovation Cluster)

8 july

Competition

Starthèse Pitch ID

This competition, for doctoral students, is inviting them to develop an entrepreneurial project based on their thesis work and then to present it clearly, concisely and convincingly, in five minutes, in front of a panel of experts.
https://www.universite-paris-saclay.fr/actualites/decouvrez-starthese-pitch-id-le-nouveau-concours-entrepreneurial-dedie-aux-doctorantes-et-doctorants

AUGUST

Parc de Moulon
Scène de recherche – ENS Paris-Saclay, Gif-sur-Yvette city council

30 august

Concert

Pulcinella « La guerre des boutons » (War of the buttons)

To celebrate the start of the new academic year on the Plateau de Saclay, the *Scène de recherche* will hold a second edition of its Grand bal du Plateau with the quartet Pulcinella from Toulouse and their lively concert "La guerre des boutons" (The War of the Buttons). Saxophone, double bass, drums and accordions will join forces to perform a swaying hybrid repertoire with Afrolatin, musette, funk and Balkan influences...
https://ens-paris-saclay.fr/en/la-scene-de-recherche

SEPTEMBER

Bures-Orsay campus
Université Paris-Saclay

26 september

Back to University

Welcome Day

Dedicated to students who are new to Université Paris-Saclay, Welcome Day is an event devoted to presenting the university's services and the facilities available to them throughout their studies. The event will feature two highlights: a booth village, from 11.30am to 3pm, where students will be able to talk to various people from the university and its ecosystem, followed by an evening dedicated to international students.

OCTOBER

Versailles, Évry, Orsay, Bures-sur-Yvette and Gif-sur-Yvette campuses
Université Paris-Saclay

4 → 14 october

Event

Fête de la science (Science festival)

Every year, this science festival at Université Paris-Saclay invites participants to meet the scientific community and discover the world of research in a playful way. The theme of this year's event is "ocean of knowledge", with a wide range of free activities for both young and older people: workshops, laboratory visits, lectures, exhibitions, a science village and scientific games.

Reading highlights

Summer 2024

The Conversation

To give your brain a boost, which physical activities are best once you are 60?

Numerous studies have shown that physical activity has benefits for the brain and cognitive abilities, even after the age of 60. But which activities are the most effective for giving your brain a boost? Alexandra Perrot and Neva Béraud-Peigné, respectively a lecturer and PhD candidate at the Faculty of Sports Sciences at Université Paris-Saclay, reveal the ingredients of the ideal, motivating recipe for training seniors.

https://theconversation.com/pour-booster-son-cerveau-quelles-activites-physiques-privilegier-apres-60-ans-228451 (in French)

Giant parasols and sky whitening: false good ideas for the climate

Faced with the threat posed by climate change, geoengineering is giving rise to numerous projects that are as innovative as they are controversial. A team of scientists, including Emmanuelle Rio, a lecturer at the Solid State Physics Laboratory (LPS - Univ. Paris-Saclay/CNRS), review two of these ideas - space parasols and the injection of sulphur dioxide into the upper atmosphere - to assess their feasibility, effectiveness and consequences.

https://theconversation.com/parasols-geants-et-blanchiment-du-ciel-de-fausses-bonnes-idees-pour-le-climat-228454 (in French)

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Sport
at Université Paris-Saclay

Sport plays a key role at Université Paris-Saclay, in terms of training, research and sports activities. Here are some key figures.

Education

1 **Graduate School Sport, Movement, Human Factors (SMHF) which supports** training of excellence in the field of sport, adapted physical activity, training and performance optimisation, ergonomics, management and engineering at the service of human movement, based on high-quality academic research and in partnership with professionals in the sport, leisure and health sectors.

4 **undergraduate degrees' tracks in Sciences and Techniques of Physical and Sports Activities** (STAPS) which in 2024 is ranked second among the most requested undergraduate degrees on Parcoursup at nation level.

1 **vocational undergraduate degree** in fitness activities.

1 **undergraduate double degree** between STAPS and engineering sciences.

7 **Master's tracks** and 10 Master's study paths covering a wide range of fields related to the practice, teaching and study of physical and sports activities.

3 **international courses** taught in English only.

1 **Doctoral school, Sports, Motor and Human Movement Sciences (ED SSMMH)** with 130 PhD students.

1 **course unit dedicated to sport** which allows students to include sports activities as part of their university course.

Sports activities

67

activities offered by the University Service for Physical and Sports Activities (SUAPS), including team and individual sports, physical fitness activities and artistic activities such as dance.

300 **hours** taught per week in the various activities.

more than **8000** **participants, students and university staff.**

A wide range of sport facilities including

3 university sports complexes

2 synthetic football fields

2 synthetic rugby fields

1 athletics track (400 m) and jumping and throwing areas

5 weight rooms

6 climbing walls

1 swimming complex (opening planned for autumn 2024).

1 student sports tournament (TOSS) organised at CentraleSupélec, bringing together some 4,500 participants each year.

Top-level sport

more than **140** **students involved in a professional sports career alongside their studies** (top-level athletes and top-level university athletes).

At least 10 athletes qualified for the Paris 2024 Olympic Games.

Research

13 **research laboratories** working on a wide range of issues relating to sport, physical activity and movement.

1 **federative research organisation**, the Fédération Demenÿ-Vaucanson, which provides an innovative and multi-disciplinary alliance at the interface of human movement science and engineering sciences.

1 **interdisciplinary initiative, H-CODE** (Human in the loop for control and decision), which aims at bringing together different communities of researchers and engineers of Université Paris-Saclay, who manipulate in their work concepts from the theory of control and decision at different scales.