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PRIZES & AWARDS

RESEARCHERS

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Alain Aspect, researcher at the Charles Fabry Laboratory (LCF – UPSaclay, IOGS, CNRS) and world expert in quantum optics and atomic physics, has been named an **honorary member of the International Optical Society Optica**.

Denis David is the recipient of the **2022 Schaefer Research Scholar Awardees** from Columbia University. His work, carried out at the Faculty of Pharmacy of Université Paris-Saclay, focuses on adult neurogenesis.

Abdallah Hamze, professor of therapeutic chemistry in the Design and Synthesis of Molecules of Therapeutic Interest (CoSMIT) team of the Biomolecules: Design, Isolation, Synthesis laboratory (BioCIS – UPSaclay, CNRS, Univ. Cergy-Pontoise), received the **Michel Delalande 2021 Prize** from the French National Academy of Pharmacy. His work has led to the discovery of several molecules with picomolar anti-proliferative activity that are effective on resistant tumour lines.

© Université Paris-Saclay

Jean-François Le Gall, professor of mathematics at Université Paris-Saclay and researcher at the Orsay Mathematics Laboratory (LMO – UPSaclay, CNRS), has been awarded the **BBVA Foundation Frontiers of Knowledge 2022 prize** in fundamental sciences. His research is in mathematical analysis and probability theory.

© INRAE

Loïc Lepiniec, researcher at the Jean-Pierre Bourgin Institute (IJPB – UPSaclay, INRAE, AgroParisTech) and regional delegate of INRAE for the Ile-de-France region, was elected **corresponding member of the French Academy of Agriculture**.

Christian Sandor, co-leader of the VENISE team at the Interdisciplinary Digital Sciences Laboratory (LISN – UPSaclay, CNRS, Centrale-Supélec, Inria), received the **2021 Best Associate Editor Award** from the IEEE Transactions on Visualization and Computer Graphics journal.

© UVSQ

Delphine Sitterlin, biochemist, virologist and lecturer at the UVSQ, was promoted to the rank of **Chevalier in the National Order of Merit** by decree of the President of the Republic. A member of the Infection and Inflammation laboratory (2I – UPSaclay, UVSQ, Inserm), her work concerns the respiratory syncytial virus (RSV) or infant bronchiolitis virus, and the study of the late stages of RSV multiplication in the host cell.

Hervé Vaucheret, researcher at the Jean-Pierre Bourgin Institute (IJPB – UPSaclay, INRAE, AgroParisTech), received the **INRAE Grand Prize for Agricultural Research**. This prize rewards his career devoted to the study of epigenetic mechanisms in plants.

STUDENTS

Léa Broca-Brisson, PhD student at the Pharmacology and Immunoanalysis Service (SPI – UPSaclay, CEA, INRAE) received an **award from the American association ACD** (Association for Creatine Deficiencies) for her thesis work on the modelling of mini-brains (cerebral organoids) of patients suffering from creatine transporter deficiency and their use as a tool to evaluate the effectiveness of potential treatments.

Yiran Zhang, a PhD student at the Interdisciplinary Digital Sciences Laboratory (LISN – UPSaclay, CNRS, CentraleSupélec, Inria) received the **Nominee Best Paper Award** (3rd prize) at the IEEE VR Conference, for her work on collaborative virtual reality.

COMPANIES/ PROJECTS

The formal proof assistant **Coq**, developed in part by the Formal Methods Laboratory (LMF – UPSaclay, ENS Paris Saclay, CNRS), is the winner of the **Open Science of Open Source Research award** in the scientific and technical quality category of the French Ministry of Higher Education, Research and Innovation.

The European project **Magnetic nanoparticle based liquid energies for thermoelectric devices applications (MAGENTA)** of the Condensed Matter Physics Laboratory (SPEC – UPSaclay, CEA, CNRS), has been awarded the **Star of Europe Award 2021** by the French Ministry of Higher Education, Research and Innovation. The project consists of the development of a technology to capture waste heat, which is inevitably generated by thermal engines and difficult to recover.

THRUSTME

ThrustMe, a start-up supported by the Tech Transfer Acceleration Company SATT Paris-Saclay, has won the **European Physical Society's 2022** Innovation Prize for its innovation in the field of space propulsion. A spin-off from the Plasma Physics Laboratory (LPP – UPSaclay, CNRS, École Polytechnique, Observatoire de Paris, Sorbonne Univ.), the start-up founded in 2017 specialises in miniaturised satellite propulsion.

ZELCOR

The **Special Jury Prize of the Stars of Europe 2021** was awarded to the European project **Zelcor**, from the APSYNTH team of the Jean-Pierre Bourgin Institute (IJPB – UPSaclay, INRAE, AgroParisTech). As part of a circular economy approach, the project aims to convert industrial by-products from wood and straw into high value-added bioproducts for cosmetics, packaging and chemistry.

EDITOR'S LETTER

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In spring 2022, scientific and academic affairs at Université Paris-Saclay are blossoming. Our graduation ceremonies are in full swing; our students continue to return to campus brimming with new initiatives; our scientific results increase with each passing week, and the website we launched highlights these results daily, so that knowledge can be shared widely with society, as continually and intensely as possible.

https://news.universite-paris-saclay.fr/en

In this edition, you will find a highly stimulating overview of our activity, but I lack the heart to give centre stage to our achievements when the war continues to strike in Ukraine, and when we can do so little for the young people and their families affected, despite our collective and individual efforts.

I would like to reiterate here my solidarity for the academic, scientific and student communities and their families affected by these tragic events. Now, more than ever, our institution defends the fundamental values of peace and democracy, and reaffirms its support for the freedom of people and ideas.

Sylvie Retailleau,
President of Université Paris-Saclay.

Keywords
Placement year – TU Science Immersion – Inria digital MOOCs

Title

The placement year: an opportunity to shape your future

© Hugo Noulin

Who hasn't dreamt of taking a break from their university studies to travel, learn a new language, carry out a project which is close to their heart or gain professional experience? But doesn't taking this time out put your future studies at risk? The answer is no, thanks to the placement year, which makes an interruption in studies possible by having the guarantee of being able to resume your studies available on your return.

After having completed the first year of his Master's degree in Nuclear Energy at Université Paris-Saclay last year, Gabriel Guerche, a student entrepreneur at the Paris-Saclay Entrepreneurship and Innovation Hub (PEIPS), is working full time at Ifremer (the French Research Institute for Exploitation of the Sea) this year on his entrepreneurial project to develop an underwater communication system. "*As part of the Octo'Pousse competition last year, I was offered the chance to receive support from a team at Ifremer and given a twelve-month fixed-term contract to develop my prototype*," explains Gabriel Guerche. The student took advantage of the opportunity thanks to the placement year scheme. "*It's really exciting to be able to devote a whole year to my project with the certainty that I'll be able to resume my place in the 2nd year of the Master's next September,*" says the student.

A wide range of motivations

Although being able to develop an entrepreneurial project is a great reason for taking advantage of the placement year scheme, motivations are sometimes very different. For Louise Poinsatte, a student studying Law, it was the desire to travel which led her to make this choice once she had obtained her undergraduate degree. "*After having a complicated final year due to the pandemic and my graduation in 2021, I really needed to get away from it all to gain confidence before I went on to my Master's degree in Intellectual Property and Digital Law. After my request for a placement year was accepted, I began by working for six months in a vaccination centre to fund my six-month break in Montreal.*"

For others, like Joséphine Renaud, a graduate who wants to consolidate her German by experiencing a year as an 'au pair', the placement year seems an obvious choice. "*Before I start my further studies, I want to see something else and prove myself. Living in Germany, looking after children and attending courses, with the prospect of joining the Jean Monnet Faculty of Université Paris-Saclay on my return, really is a great opportunity.* "

Théodore Babarit decided to take a placement year to campaign as a candidate in the general elections after the first year of his Master's degree in Environmental Law. "*As the months went by, I realised that this break allowed me, in addition to my initial project, to really question myself and to envisage my future differently.*"

Whatever their motivations were at the outset, one thing is certain – all these students will return better equipped to start, continue or complete their studies.

Preparing for a placement year at Université Paris-Saclay

Just like Gabriel, Louise, Joséphine and Théodore, any student at Université Paris-Saclay wishing to temporarily interrupt their studies to gain further experience can do so through the placement year scheme. All you have to do is register for one of the University's

courses, contact your Faculty's placement year advisor and submit your application via an online form, attaching your CV and an outline of your plans and its motivations. *"The purpose of this temporary suspension of studies, which lasts for one or two semesters, is to allow students who so wish to take a break in order to enrich their studies, acquire new skills and have other experiences, while remaining students,"* explains Marylène Janmot, Deputy Director of the Department of Training and Success at Université Paris-Saclay. For those who are interested in this idea but do not know where to start, they can be confident that they will find tailor-made support at Université Paris-Saclay. *"The Department of Training and Success supports students in the early stages of their planning and afterwards helps them to assess their experience in the light of the objectives set at the outset,"* adds Marylène Janmot.

Participating in community initiatives and becoming involved in a sustainable future

It is not surprising that many students are seizing this opportunity. In 2020/21, 41 students of École Normale Supérieure (ENS) Paris-Saclay have taken part – a quarter of them in humanitarian, community and outreach projects, including a permaculture farm project, support and extracurricular guidance for young people and civic service as a volunteer designer, etc. *"Three ENS Paris-Saclay students are now on an expedition to the Antarctic as part of a research and public awareness project on environmental issues. This project, originally a placement year, has been recognised as part of the degree at ENS Paris-Saclay. This has led us to think about giving more value to this type of initiative within the framework of a specific year, for example as a commitment on the part of the ENS Paris-Saclay,"* explains Caroline De Sa, Vice-President for Studies and Student Life at ENS Paris-Saclay.

This desire to be engaged is also very much in evidence and encouraged at CentraleSupélec as part of the Shift Year. This placement year, taken between the 1st and 2nd year of the Master's degree, is organised in two phases. The first is a semester about transitions during which the students benefit from training and are entrusted by one of CentraleSupélec's partners with a task which must be carried out in a group. The second is a semester of immersion during which students work in an area aiding transition. *"The Shift Year, which is aimed at both our own students and students from elsewhere to ensure a disciplinary balance, aims to develop a comprehensive view of the world and its transitions*," explains Julien Colin, co-leader of the Shift Year. *"The aim is to understand the issues affecting sustainability and to take action using multidisciplinary approaches. It is also an opportunity for everyone to build up a strong network,"* adds Jacques Millery, who also co-leads the Shift Year.

https://www.universite-paris-saclay.fr/cesure-universitaire
https://atelier-des-transitions.eu/shift-year/

Title

MOOCs for digital training

"The general public, educators and students can learn about the environmental impacts of digital technology thanks to Impact'Num," explains Benjamin Ninassi, co-creator of the MOOC and IT project manager at the Inria Directorate General for Science. The programme is very comprehensive and includes environmental indicators, the equipment lifecycle, the ecodesign of digital services and economic and societal aspects. It takes five hours to complete the initial course and gain an understanding of the subjects, and between ten and twenty hours to study them in greater depth using the concept files, which will soon be in English. The MOOC Scikit-learn, for its part, *"Is born of a desire to educate the non-specialist public about machine learning,"* explains Gaël Varoquaux, a researcher from the SODA project team at Inria Saclay and co-designer of the Python Scikit-learn library. Participants learn how to build predictive models and understand the benefits and limitations of machine learning. *"We're continually improving the MOOC so that it remains educational,"* adds his colleague David Arturo Amor Quiroz, who works with the teaching team. Although Impact'Num is available continuously, access to Scikit-learn is available from mid-February 2022 for thirty weeks.

https://www.fun-mooc.fr/fr/cours/impacts-environnementaux-du-numerique/
https://www.fun-mooc.fr/fr/cours/machine-learning-python-scikit-learn/

Title

Applying knowledge in an extraordinary context

© La Physique Autrement

For several years, the Science Immersion teaching unit (TU) has been placing students studying for the undergraduate joint degree in mathematics, physics and engineering science at Université Paris-Saclay in a scenario worthy of a suspense thriller. Students have had to help a crew complete its space mission live, for example. The aim is for students to work together and resolve several scientific, creative and fun challenges by applying their knowledge to an unusual context. This distinctive educational approach has changed students' engagement. *"This approach alters their view of experimental science. Their motivation and involvement becomes clearly evident,"* explains Julien Bobroff, a researcher at the Solid State Physics Laboratory (LPS – Univ. Paris-Saclay, CNRS) and co-creator of the TU alongside Frédéric Bouquet. With the support of gaming specialists and designers, they now want to expand this initiative and develop a turnkey version which could be used by any interested educationalist.

https://hebergement.universite-paris-saclay.fr/supraconductivite/projet/immersion_scientifique

Keywords
SAPS label – Harmonic telescope – VolvoX

Title

The Science with and for society (SAPS) label of Université Paris-Saclay

At the end of 2021, the French Ministry of Higher Education, Research and Innovation announced the first eight university centres to receive the SAPS label within the context of measures resulting from the law concerning research programmes in the area of Science with and for society. One of the winners was Université Paris-Saclay.

This label, with funding, is a recognition of the strategic commitment of the University's governance team, of the strong partnership already established with certain key players in the region, of the diversity of the initiatives implemented, and of the University's self-evaluation process.

In addition to its training, research and innovation activities, the University gives pride of place to its relationship between science and society, which is enshrined in its statutes. It is committed to the sharing and dissemination of research results, the fight against misinformation, the popularisation of science, scientific and cultural outreach, the interaction between arts and sciences, the development of scientific heritage and the promotion of culture and artistic practice. As a result, it regularly organises festivals, welcomes school pupils to its laboratories and supports and accompanies the initiatives of its scientists and students, in particular through calls for projects by the Diagonale Paris-Saclay.

The aim with the SAPS label is to strengthen this connection even further. "*In France, unlike in some Northern European or English-speaking countries, science and society initiatives have traditionally been developed outside higher education and research establishments (HER). The Ministry's intention is to now give universities the means to co-construct initiatives in consultation with local actors (local authorities, the Centre for Scientific, Technical and Industrial Culture, associations and individuals, etc.) This is what makes the SAPS label so special,*" says Olivier Kahn, Director of the Diagonale Paris-Saclay. "*This label will allow us to streamline our initiatives. Whereas we used to have a project-based approach, we're now moving towards a more long-term partnership approach when co-structuring projects. And thanks to an international benchmark, we will also identify areas where we need to improve.*"

The strategy focuses on four issues, namely cultural, democratic, educational and social. "*We've decided to give priority to working with people who are not involved in HER, either socially, culturally or geographically. We'll also develop interaction between the worlds of politics and science. The idea is to strengthen how much scientists are heard so that science is better represented in the media and in political choices. It's also a question of improving the image of research and ensuring that young people have a good understanding of the scientific method and do not fall into the trap of 'fake news'. Finally, a training component will target our academic community to improve their scientific outreach skills, and primary and secondary school teachers to upgrade or update their knowledge on scientific topics and current research.*"

Title

Volvox: Spotlight on the colours of gold at nanoscale

© Thierry Touitou

The Volvox project, which is the result of a collaboration between artists and scientists, is inspired by the microscopic algae of the same name. As it moves, this green freshwater alga creates turbulence in the movement of other micro-organisms to the extent that it generates synchronised collective behaviour. The project applies this phenomenon using gold nanoparticles enclosed in glass capsules, which are themselves driven in a random and synchronised dance while suspended in a rotating sphere. By altering the angle of observation in relation to the incidence of light, the viewer experiences a relative perception of colour as the gold changes from blue to orange. The installation, which is a work of art and a powerful educational tool, delighted the public during its presentation at the CNAM at the end of 2021. "*It illustrates in a magical way physical properties which are often difficult to imagine. Many people have approached us to ask more about what they saw*," explains Bruno Palpant, a physicist at the Light, Matter and Interfaces Laboratory (LuMin – Univ. Paris-Saclay, ENS Paris-Saclay, CNRS, CentraleSupélec) and one of the project's architects. Several new exhibition sites are planned and Volvox is also due to inspire a musical creation.

https://vimeo.com/691301145

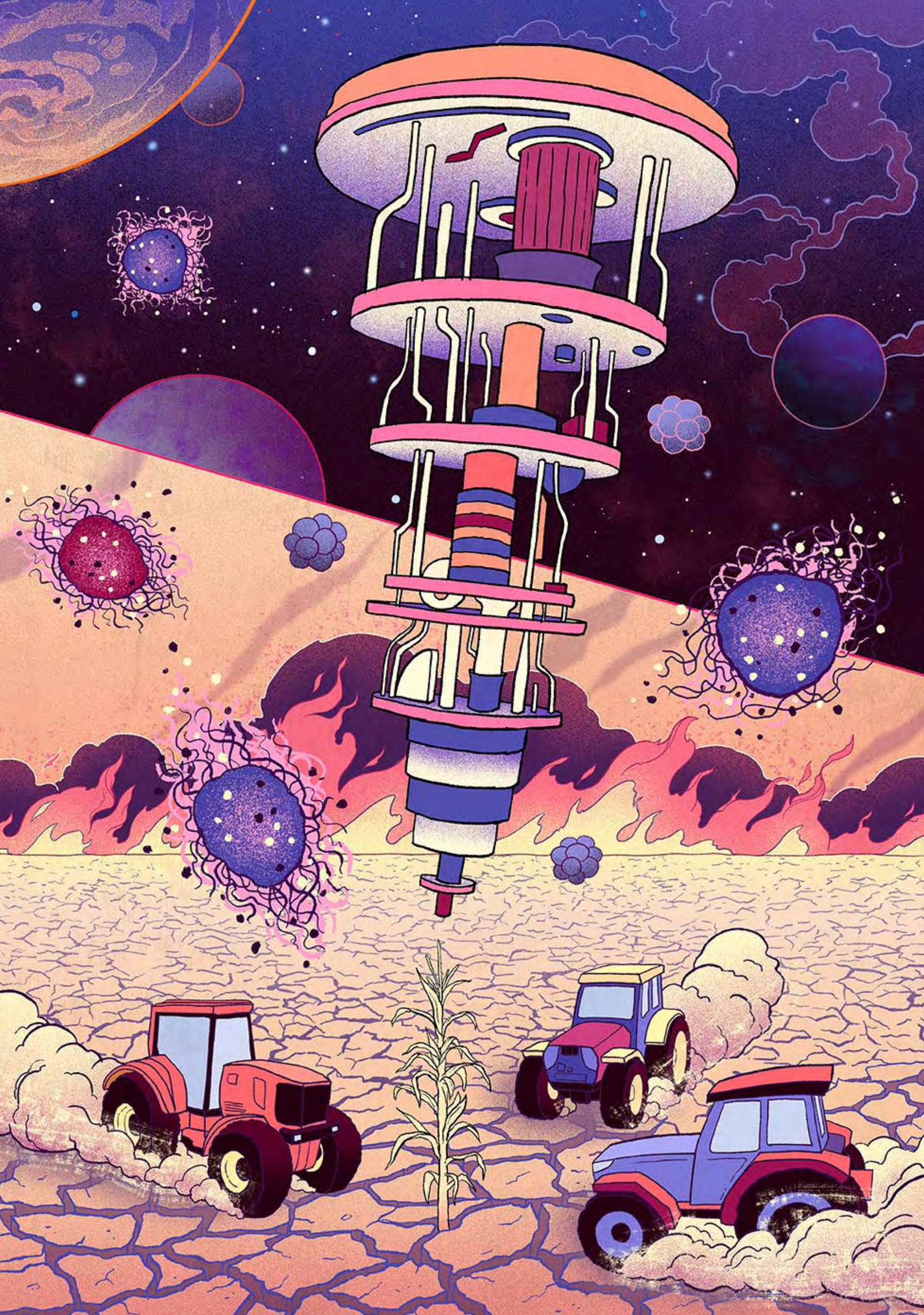
Title

The "harmonic telescope": Go on a hunt for exoplanets

The James Webb Space Telescope (JWST) set off on its space mission on 25 December 2021. The mission, the result of an international collaboration which includes laboratories from Université Paris-Saclay, aims, among other things, to study exoplanets in depth. In 2019, a team of scientists and artists led by CEA, CNRS and CNES created the Harmonic telescope gaming platform to promote JWST among the general public. Nine players divided into three groups hunt for exoplanets. A musical creation adds to the experience. Each player chooses a system of exoplanets which is linked to a certain number of sounds. This is then played at the end of the game. The immersive version of the platform requires a space which meets specific criteria, and the digital version requires a customised terminal. A video game is being created on the project website.

https://www.telescope-harmonique.fr/

Illustrations right-hand page and page 22: **Antoine Doré**



Title

Global food security in the context of global warming

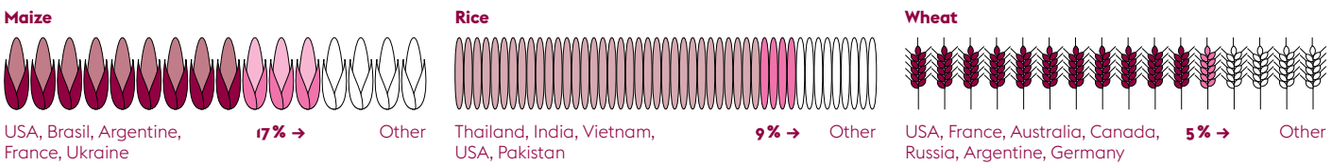
SYNTHESIS OF LITERATURE ON THE PROJECTED IMPACTS OF CLIMATE CHANGE ON DIFFERENT CROPPING SYSTEMS

Life history strategy	Crop type	Climate change (general)	Temperature (including heat stress)	Precipitations (inclouding drought, flood)	Phenology & seasons	Carbon dioxide	Pests & diseases	Ecosystem services	Combined (sum of all drivers)
Annual (above ground)	Vegetable					–			
	Legumes							–	
	Leafy crops	–	–	–	–	–		–	
	Soft fruit		–	–		–			
Annual (below ground)	Root crops							–	
Perennial	Tree fruits & nuts					–			
All									

Average direction of impact: Negative, Mixed, Positive
Average confidence in attribution: Low, Medium, High
– Not assessed

From the sixth assessment report, *Climate Change 2022: Impacts, Adaptation and Vulnerability,* Contribution of Working Group II, IPCC.

GLOBAL EXPORT TRENDS BY 2080 IN RELATION TO CLIMATE CHANGE



% of export shares of major exporting countries to be shifted to other countries

According to the United Nations (UN), around a tenth of the world's population is facing malnutrition. How can global food production adapt to a constantly growing population and the challenges posed by global warming?

Global warming, which humans have been causing since the start of the industrial era (at the beginning of the 20th century) is a threat which affects the whole human population across the entire world. The press release from the Intergovernmental Panel on Climate Change (IPCC) begins with these words on the evening of 27 February 2022. On this day, the group of scientists presented the second part of its sixth assessment report on global warming. In this report, which contains over 3,600 pages, the consequences (both present and future) of climate change on the Earth, the areas of vulnerability and the ways in which we can adapt are discussed. "*This report issues a very serious warning about the consequences of inaction,*" points out Hoesung Lee, President of the IPCC.

A few weeks later, on 4 April, the third and final part of the sixth IPCC report was published. This part provides an updated global assessment of past and present greenhouse gas emissions and possible progress and commitments to mitigate global warming. It provides outlooks and options for reducing emissions in key sectors (energy, transport, buildings, industry, agriculture, land use and food, etc.). According to the IPCC experts, even though global warming has already had irreversible effects on the planet's environment, there is still time to act and protect the future of humanity. But this is on the condition that action is taken now: if greenhouse gas emissions do not stop rising within three years, and if they have not been halved from current levels by 2030, the temperature increase by the end of the century will irrevocably exceed +1.5°C compared to the pre-industrial era. And future living conditions will be significantly worse for all humanity.

The fifth chapter in this second part of the report deals more specifically with food produced from ecosystems. The IPCC highlights the impact, which is already apparent, of climate change on global agri-food systems which have plunged hundreds of millions of people into food insecurity. According to the experts of the third working group of the IPCC, agriculture, forestry and other land uses accounted for between 13% and 21% of human greenhouse gas emissions between 2010 and 2019. The group of scientists explains that the global food system is currently failing to address issues of food insecurity and malnutrition in an environmentally sustainable manner. Whether directly or indirectly, climate change is affecting the world's crops and the four pillars of food security (accessibility, availability, use of food and stability of supply).

How climate change affects crops

According to the latest report from the IPCC, the number of factors affecting world food production as a result of global warming are numerous. The group of researchers from 195 countries have found that climate change has already had a major impact on crop yields, their quality and marketability. "*There is moderate evidence and a broad consensus that the effects of human-induced global warming since the pre-industrial era have had significant negative consequences on global agricultural production, acting as a brake on the growth of such production,*" write the IPCC experts in their report. The scientists cite several studies which support

this, including one showing that total factor productivity (TFP), which combines all crop productivity coefficients, was reduced by 21% between 1961 and 2015 despite the many technological advances over the previous decades. These effects vary according to the region in the world. Compared to a model excluding the consequences of human-induced global warming, TFP falls by 30-33% in Africa, Latin America and the Caribbean, for example.

The IPCC experts report that the reasons for this loss in productivity are manifold. First and foremost, the number of unpredictable weather events (droughts, cyclones, etc.) is increasing. If the climate projection 'fossil-fuel based development (SSP5-8.5)' scenario is followed, "*Overall, 10% of areas currently suitable for large-scale crop and livestock production will become unsuitable in terms of their climate by 2050, and between 31% and 34% of these areas by the end of the century,*" the IPCC warns. Heat waves and periods of drought are increasing and these events impact agriculture either directly or indirectly, with crops dying, or planting becoming impossible or delayed. In Europe, crop losses from these two types of catastrophic event have tripled in the last 50 years, the IPCC reports. Flooding is also increasing across the globe. The UN Food and Agriculture Organisation (FAO) estimates that the flood which devastated Pakistan's crops in 2010 is equivalent to a loss of more than €4 billion for local farms. The Sahel region of Africa has suffered some of the worst periods of variation in rainfall over the decades, with twenty years of heavy rains followed by twenty years of drought greatly reducing the cultivation capacity of the region between 1950 and 1990.

In addition to the increase in natural disasters, global warming has also led to an increase in weeds on farms. These have always had the capacity to ravage crops (grains, grazing and forestry), but scientists at the IPCC have shown that global warming favours their increase due to several criteria.

First and foremost, these invasive plants are more likely to grow in places where there are higher levels of carbon dioxide (CO_2) and higher temperatures, according to a recent meta-analysis cited by researchers at the IPCC. However, the scientists note that the growth of such plants in regions with areas of low fertility offers interesting opportunities. The concentration of CO_2 also changes the biochemistry of plants, making weeds more resistant to herbicides, for example. Climate change and the physical changes it brings to the environment (e.g. changes in precipitation rates) directly damages the quality of the distribution of herbicides.

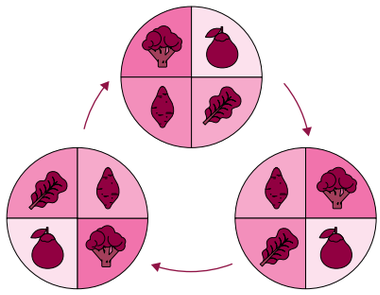
Extreme changes in rainfall rates also have an impact on the quality of the soil in which crops are grown. According to the IPCC, these reduce the effectiveness of the soil biology and increase the risk of flooding, waterlogging and land erosion. The rise in sea level is another danger for soil balance and is the cause of the acidification and increased salinity of coastal soils, which has already killed many crops.

The IPCC Working Group II has created a non-exhaustive list of consequences (both direct and indirect) of global warming on world agriculture. "*Food and nature interact in complex ways through political, economic, social, cultural and demographic factors, leading to issues of food security and sustainability*," the scientists write at the start of chapter 5 in the report. The response to combat these changes, which today are driving hundreds of millions of human beings towards food insecurity, will have to be global.

Are there other ways to cultivate land?

We will have to change how we cultivate the land in order to alleviate the drop in crop yields resulting from global warming. For David Makowski, who works at the Applied Mathematics and Computer Science unit (MIA – Univ. Paris-Saclay, INRAE, AgroParisTech), agroecology is one of the solutions to be explored. Moreover, the IPCC scientists make the same observation: in the third part of their sixth report, agro-ecology is presented as a viable solution to mitigate greenhouse gas emissions from the agricultural sector. "*It's a current trend which aims to harness the natural resources necessary for agricultural production by limiting the use of chemicals to a minimum,*" explains the researcher. "*This involves finding all the natural means possible to limit the use of fertilisers and pesticides, etc. For example, species such as legumes which fix nitrogen from the atmosphere can be used, as well as biological control methods which limit the impact of crop-damaging diseases while using as few environmentally harmful chemicals as possible.*" Agroecology is a combination of practices which aims to preserve the environment while maintaining a high level of agricultural output. "*In reality, it's difficult, however, to achieve no yield loss at all with agroecological practices compared to crops using a range of chemical products,*" observes David Makowski.

Conservation agriculture is a farming method which has been proposed in this context. "*It's a specific system which combines three practices, i.e. no tillage, crop rotation (at least three crop species grown in rotation) and maintenance of plant cover for the soil. Conservation agriculture has been the focus of numerous trials in many regions across the world for different reasons. These are both economic (the lack of tillage means farmers expend less energy and save time) and ecological (improvement in soil quality). In principle, conservation agriculture means more carbon is locked into the soil, the soil's biodiversity is improved and the risk of erosion is reduced,*" explains David Makowski.



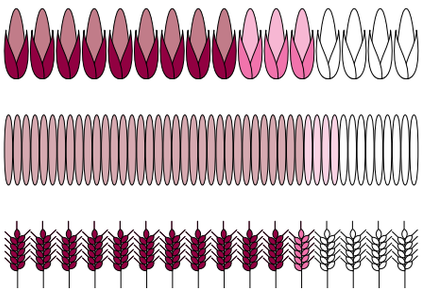
Conservation agriculture has attracted a lot of attention, some of which goes against the founding ideals of this type of farming practice. "*This system is associated with the use of genetically modified crops on the American continent. These are resistant to glyphosate, a very powerful herbicide. Tillage basically kills weeds. When no tillage takes place, the weeds grow much more easily, start to compete with the crop and reduce yields,*" explains David Makowski. To manage this problem, manufacturers proposed the use of glyphosate, which required the development of glyphosate-resistant crops. This has been achieved by genetically modifying certain crop species, such as maize and soybeans. "*It's a real 'technological package' which has been developed involving no tillage, combined with genetically modified crops and glyphosate. This has worked very well and was quickly applied on a very large scale in North and South America. It's a bit of a paradox because this system of conservation agriculture has been championed by agribusiness as a way of producing crops on a large scale and intensively, but has also been championed by agroecology advocates who have ideals to do with environmental protection.*"

In his latest work based on the meta-analyses of data obtained from agroecological production systems, David Makowski has looked at the success different agricultural practices have in achieving high yields while limiting the environmental impact they make. "*To what degree can we limit the risk of water pollution or greenhouse gas emissions? To what degree can we increase biodiversity in agroecological systems?*"

Adapting crops to climate change

Global warming has already altered the planet and global agricultural systems. Rising temperatures have dried some countries, drastically reducing their capacity for agricultural

production. "*There will be winners and losers,*" explains David Makowski. "*It's clear that there will be major problems caused by global warming, but also opportunities. The question is, what will they be and how can we make the most of them?*" Regions in the world where growing cereal crops was difficult in the 20th century have already profited from the rise in temperatures. Ukraine and Russia, for example, have become important wheat producers over the past years, and this is partly thanks to global warming. In light of the Russian invasion of Ukraine, it is important to stress that war and food insecurity go hand in hand. Russian aggression will have a strong impact on the supply of agricultural raw materials, particularly in North Africa and the Middle East.



Several strategies already exist for adapting to climate change. The rise in temperatures has already made it possible to increase the number of annual harvests in some regions (on average, two to three rice harvests per year take place in South Asia). Plant breeding is also being studied to ensure that the best species are grown for the changing climate. "*Adapting to climate change should be some of the strategies to consider,*" points out Christophe Gouel, who works at the Paris-Saclay Applied Economics Laboratory (PSAE – Univ. Paris-Saclay, INRAE, AgroParisTech). "*When we talk about adapting agriculture, we're talking about the development of new drought-resistant seeds, the construction of dams to irrigate crops, etc.*" However, we often forget that adaptation can also be achieved via agricultural markets. In his recent work, the researcher addresses the question of the global changes in diet which will occur.

Farmers throughout the world will be encouraged to plant different crops both because of differences in yields due to climate change as well as changes in prices. According to simulations by Christophe Gouel, the role the market plays in how agriculture adapts to global warming will be essential. Without this adaptation "*there are significant losses due to climate change, but these are even greater if changes in the tradeflow are prevented. It is also shown that as a result of climate change, significant trade changes will take place. Certain countries with a history of exporting will lose this role. However, countries where the climatic conditions are the most extreme today, such as Argentina, will become the greatest producers. There will be significant change in how trade is shared out.*"

Finding answers to food insecurity

Would it be possible to feed the world's population, a large part of which is already at risk of food insecurity, as the effects of global warming increase? "*Theoretically speaking, the results put forward by the literature say yes,*" says David Makowski. "*It would be difficult without intensifying agriculture, at least in certain geographical zones where agriculture is currently relatively extensive, such as the African continent for example. This would be much easier as our diets evolve – in particular if we eat less meat. Populations are increasing and so is the demand for food, but there is still some room for improvement, especially in terms of yields. Also, as regards climate change, there's room for improvement in terms of increasing the amount of land available for cultivation in areas which are currently difficult to cultivate due to low temperatures. In terms of food security, I think the overall picture of the scientific findings is that we could be fine.*"

As the IPCC and the FAO have shown, if nothing is done about adapting to global warming, it will worsen the global food insecurity situation, which affects nearly 800 million people already, according to the UN. For in the next twenty years, global warming will increase further. It is therefore more important than ever to adapt food production practices and, at the same time, to work on mitigating climate change in order to limit its consequences on the planet. Here again, agricultural practices and food consumption patterns will have to change.

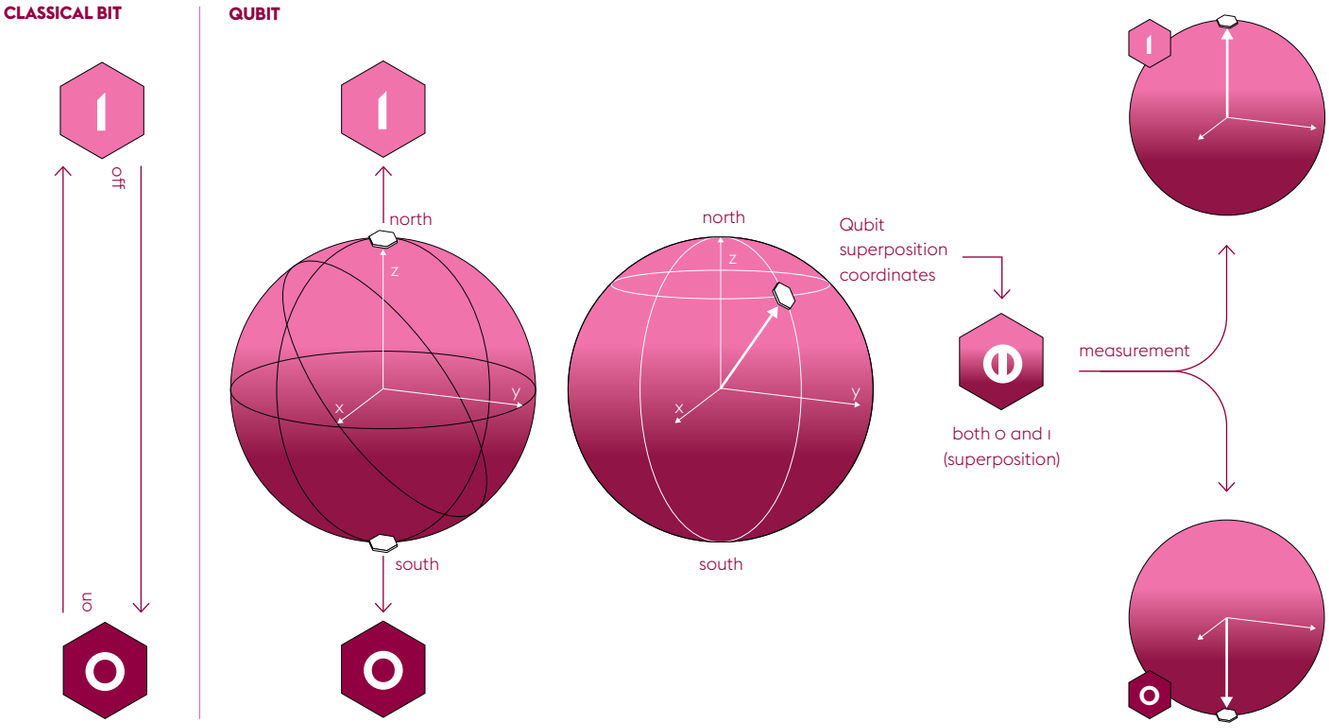
Publications

- IPCC WGII. *Sixth Assessment Report – Chapter 5: Food, Fibre, and other Ecosystem Products.* 2022.
- Su, Y., Gabrielle, B. & Makowski, D. *A global dataset for crop production under conventional tillage and no tillage systems.* Sci Data 8, 33, 2021.
- Gouel C., Laborde D. *The crucial role of domestic and international market-mediated adaptation to climate change.* Journal of Environmental Economics and Management, Volume 106, 2021.

Keywords
Quantum technologies PEPR –
Quantum computers – Quantum information

Title

Quantum ambitions: positioning France at the cutting edge of technology



An overview of some of the projects that are part of France's national quantum strategy, in which Université Paris-Saclay researchers are involved.

The President of Université Paris-Saclay, Sylvie Retailleau announced in the lead-up to the conference "*Ambitions quantiques: renforcer le leadership de Europe*" (Quantum ambitions: strengthening Europe's leadership), which took place on 21st February 2022 as part of France's EU presidency: "*Quantum technology development is now at a crossroads of opportunities and challenges*".

With their strong potential for disruption and economic and societal transformation, quantum technologies are one of the most competitive research areas, located at the interface between basic and applied research. Their potential impact, whether in new approaches to high-energy physics, quantum chemistry, quantum computing, quantum cryptography or quantum sensors, explains why these technologies are the subject of an intense global race between research laboratories, emerging start-ups and digital giants.

A dedicated national strategy

As part of the Quantum Plan – the French quantum strategy – launched by the French President Emmanuel Macron on 21st February 2021 at the Saclay plateau, the Quantum Technologies Priority Research Programmes and Equipment (PEPR) is one of the first systems to be created to support world-class research in this field. Directed by the CEA (the French Alternative Energies and Atomic Energy Commission), the CNRS (French National Centre for Scientific Research) and Inria (the French National Institute for Research in Digital Science and Technology), its objective is to place France at the forefront of this development and consolidate French leadership.

With a budget of 150 million euros, the PEPR Quantum Technologies programme supports projects that focus on six areas: quantum accelerators and simulators; scaling up the quantum computer; quantum sensors; post-quantum cryptography; quantum communications, and enabling technologies. The programme also covers four multi-disciplinary focuses, which are: developing human capital, strengthening technological infrastructures, improving the entrepreneurial environment and strengthening inter-disciplinary collaboration and risk-taking in upstream research. In early March 2022, the first ten projects involving laboratories and start-ups from the Paris-Saclay, Grenoble and Paris-Centre quantum clusters, and two EquipEx+ structural facilities were selected for funding. Researchers from Université Paris-Saclay are involved in seven of these projects as well as in EquipEx+ e-DIAMANT, directed by the École Normale Supérieure Paris-Saclay, which will create the entire diamond manufacturing chain for quantum applications.

Qubits and quantum information

A research focus, the qubit is the quantum counterpart of the traditional computer bit. While the traditional bit transcribes information in a binary way (0 or 1), according to whether or not there is an electrical current present and electric charges are circulating in the system, the qubit is generated by quantum objects (atoms, particles, spins, etc.) integrated in the system and its state (or value) is not as clear-cut. This state is defined as a superposition of the 0 and 1 states and is expressed by a mathematical equation that shows an infinite number of possible values.

As a result of this, the information contained in the qubits is extremely rich. It is this richness that has created much enthusiasm about the quantum computer, which is expected to yield a tenfold increase in computing capacity. In such a system, computational operations are performed by acting on the qubits by means of physical devices. However, this is where the problem lies. Quantum superposition, and quantum effects more generally, are fragile and very sensitive to the environment and to outside disturbances that inevitably effect physical systems. Quantum superposition can quickly be collapsed and lead to qubit decoherence. This decoherence makes the qubits illegible and this affects the quantum information: it is deteriorated by an accumulation of random errors.

The importance of coherence

One of the challenges is to succeed in prolonging the coherence of qubits as much as possible, i.e.: their stability and the duration during which it is possible to carry out calculations. To do this, several types of qubits are being researched. Their characteristics vary according to the type of quantum object on which they are based: superconductors, trapped atoms, photons, nuclear spins, electron spins, etc. However, despite numerous announcements concerning the ever-increasing number of qubits reached by the quantum processors developed by the industrial giants, there is still no hardware architecture capable of generating qubits protected against decoherence.

The most common approach to combat this is the use of redundancy: instead of being encoded in a single qubit, the quantum information is written in a large number of qubits. These 'physical' qubits, which form a 'logical' or 'protected' qubit, preserve the quantum information. Although promising, this approach requires a very large number of physical qubits to form a single logical qubit. However, the most optimistic predictions agree that 1,000 physical qubits are needed to obtain 1 logical qubit in order to succeed in running algorithms with low demand, and with error rates of less than 1% on all operations.

More robust qubits for quantum computing

The RobustSuperQ project aims to accelerate French R&D on hybrid superconducting qubits protected by construction against decoherence. In the next five years, the plan is to develop new generation superconducting qubits as well as a new type of quantum processor, which is corrected, high-fidelity, controllable and measurable, and composed of very robust physical qubits, a small number of which form a logical qubit.

In collaboration with all the academic and private participants of the quantum circuit community (including the manufacturer ATOS and the start-ups C12 and Alice & Bob), the Quantronics and Nanoelectronics Groups in the Condensed Matter Physics Laboratory (SPEC – Univ. Paris-Saclay, CEA, CNRS), teams from the Institute of Theoretical Physics (IPhT – Univ. Paris-Saclay, CNRS, CEA) and the Theory team of the Solid State Physics Laboratory (LPS – Univ. Paris-Saclay, CNRS) will research three development areas in parallel: dynamically stabilised "cat" qubits, a hybrid architecture based on highly coherent electronuclear spins magnetically coupled to superconducting circuits, and superconducting qubits that are topologically protected against decoherence.

Towards new quantum simulators

Although a universal quantum computer is still far off, there are platforms that are already capable of carrying out complex quantum simulations that are inaccessible using traditional computing methods. Some are based on arrays of atoms trapped by a system of "optical tweezers", brought into interaction using a laser that plunges them into a very high level of excitation called the "Rydberg state". Others use ultra-cold atoms, cooled to temperatures approaching absolute zero (0 K or -273.15 °C) – interacting in optical gratings using laser beams.

The objective of the QubitAF project is to improve these two platform types by increasing the number of atoms manipulated, and to characterise and certify the results. The three experimental groups involved, including Charles Fabry Laboratory (LCF – Univ. Paris-Saclay, IOGS, CNRS), and the start-up Pasqal from the LCF, will have the goal of developing a new generation of Rydberg simulator, as well as new types of cold atom simulators. The aim is also to develop new tools to diagnose the quantum properties of these systems, such as quantum entanglement or quantum correlation.

Improving fault tolerance

While a large number of qubits and sufficient coherence are important elements, it is also necessary for the system to be able to maintain a low error rate. This requires the implementation of error correction processes: correcting codes. Their role is to relocate the quantum information from one part of the system to other physical systems, to better protect it from background noise.

The NISQ2LSQ project, involving around 20 academic teams including SPEC's Quantronics and teams at LCF and the Centre for Nanoscience and Nanotechnology (C2N – Univ. Paris-Saclay, CNRS, Univ. de Paris), as well as the start-ups Alice&Bob and Quandela from C2N, aims to develop new error correction strategies, thereby obtaining fault-tolerant quantum computers. Research will focus on bosonic codes, photonic codes and LDPC (Low-Density Parity-Check) codes, which will be explored on two types of physical platforms: superconducting circuits and photonic circuits. Within five years, the partners aim to build a prototype superconducting quantum processor based on cat qubits, which is more fault-tolerant, to define measurement-based computing architectures exploiting photonic codes, and to determine the elements necessary for their construction.

More efficient and advanced quantum algorithms

To obtain a real quantum advantage, it is not enough to build a machine that works according to quantum principles, you also need to develop efficient algorithms that exploit the specificities of quantum mechanics and are capable of resolving problems efficiently. One of the challenges is to introduce new algorithmic techniques with real proven advantages, but also to enrich the potential application areas of quantum information processing.

More than 20 academic and private partners will work on the EPiQ project to develop quantum algorithms in the areas of optimisation, machine learning, simulation of physical systems or chemistry, both for NISQ (Noisy Intermediate-Scale Quantum) machines – machines with 50 to 100 qubits without reliable error correction but still capable of performing tasks superior to conventional computers – and for fault-tolerant machines. The QUACS project team from the Formal Methods Laboratory (LMF – Univ. Paris-Saclay, CNRS, ENS Paris-Saclay, CentraleSupélec, Inria), teams from the Systems and Technology Integration Laboratory (List – Univ. Paris-Saclay, CEA), the Interdisciplinary Laboratory of Digital Sciences (LISN – Univ. Paris-Saclay, CEA, CNRS) and IPhT will focus on developing new quantum algorithms, better defining the architectures and languages of current machines, and simulating them to better understand them.

Quantum cryptography and communication: better resistance to attacks

With progress made in quantum computing, the whole field of cryptography and communication security is being challenged, particularly the web and its TLS protocol (the browser

padlock). While this security is based on the robustness of cryptographic algorithms that are difficult to solve using a conventional computer, they would offer little protection from a quantum computer. Faced with such threats, partners working on the project PQ-TLS, including the Mathematics Laboratory of Versailles (LMV – Univ. Paris-Saclay, UVSQ, CNRS) and the LMF, aim to develop new encryption and signature schemas to bring cryptography into the post-quantum era and make protocols resistant to attack.

Quantum key distribution is also based essentially on the assumption that the devices used perform exactly the operations envisaged by the protocols. In practice, this is difficult to verify. The objective of the DIQKD project, which includes a team from the IPhT, is to produce the first "black box" quantum key distribution prototype, capable of guaranteeing unprecedented confidentiality of communications over a greater distance, and of resisting quantum attacks for devices that are not or only partially characterised. Another project, QcommTestbed, in which C2N is involved, aims to provide academic and industrial teams with a flexible and scalable national test infrastructure for quantum communication applications. This testbed will be used to progress from laboratory demonstrations to field prototypes and commercial products.

These are all elements that should serve to shift the development of quantum technologies into a new era.

Titre

Anticipating the quantum computer's response

At IJCLab, Denis Lacroix and his team are designing algorithms capable of describing sets of interacting particles. They are testing their calculations in anticipation of future quantum computers.

A theoretical physicist at the Irène-Joliot Curie Physics of Two Infinities Laboratory (IJCLab – Univ. Paris-Saclay, CNRS, Univ. de Paris), Denis Lacroix studies the strong interactions between protons and neutrons in atomic nuclei, which he usually models on conventional computers. "*But with a large number of particles interacting, matrices quickly reach critical dimensions and explode,*" explains the researcher. Such limitations can potentially be eliminated with a quantum computer.

With his team, Denis Lacroix analyses the way in which it will be possible to use these machines. "*We are preparing for the future, for the day when they will be ready.*" The researcher is developing methods and algorithms that aim to resolve problems that conventional computers cannot tackle. In his latest work, he is interested in the total spin of an n-body system. "*We developed an algorithm that can sort the total spin of a set of particles, i.e. filter this disordered system to retain only those spins that are in a given orientation.*" He also sought to calculate the energy of a quantum system in different states. "*The method is iterative and hybrid: the parameters of the system are varied on a conventional computer, then its energy is calculated on a quantum computer using a wave function that we have prepared, and the parameters are readjusted as we go along.*"

To test the developed algorithms, the researcher uses a quantum computer simulator made available free of charge by IBM via the Cloud. "*We are working 'as if' we were working with a real quantum computer, without having the most recent developments.*" In the future, the researcher plans to push the description of the nuclei to the limit: "*It is about going towards larger and larger nuclei, and seeing how the system evolves, how it vibrates, moves, and goes as far as fission.*"

Publication • Guzman E. A. R., Lacroix D. Accessing ground-state and excited-state energies in a many-body system after symmetry restoration using quantum computers. *Phys. Rev.* C 105, 024324, (2022).

Titre

A highly sensitive microwave photon detector

At the Condensed Matter Physics Laboratory (SPEC – Univ. Paris-Saclay, CEA, CNRS), Emmanuel Flurin and his colleagues are pushing the limits of magnetic resonance with an ingenious microwave photon counter capable of detecting a very small number of electron spins.

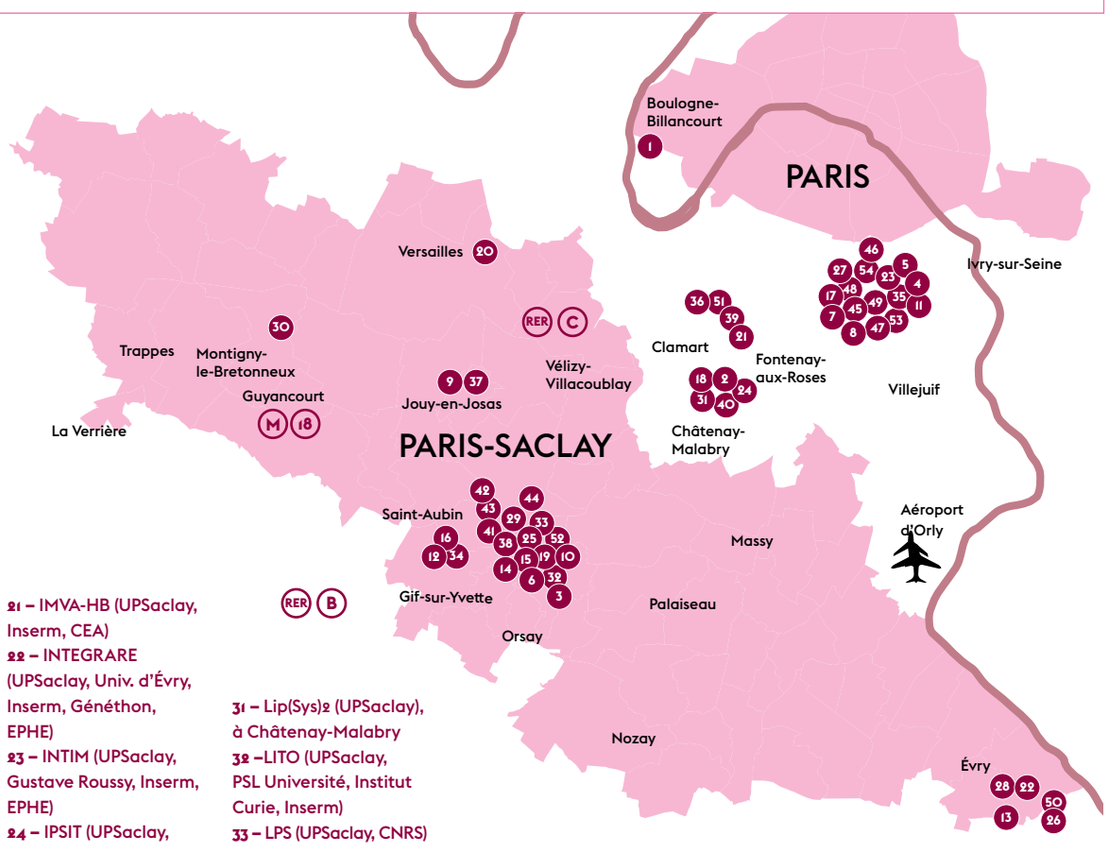
The device developed by SPEC scientists combines superconducting quantum circuits and electron spins in solids, and is applicable at cryogenic temperatures. Spin is a system with two distinct quantum levels – basic and excited – which switch from one state to the other via the absorption/emission of a single photon whose energy is in the microwave range. Since de-excitation only occurs spontaneously after a very long time, it is possible to accelerate it by using a superconducting resonant cavity. The emitted photons are then collected by the microwave photon counter, which consists of a superconducting qubit capable of irreversibly absorbing the photon. The qubit's subsequent measurement in its excited state signals the presence of the photon and results in a detector click. "*Counting spins is like reading the superconducting qubit in its excited state,*" sums up Emmanuel Flurin. The team recently provided a proof of principle by detecting a small set of electron spins in silicon.

The INGENIOUS project, awarded an ERC Starting Grant in 2021 and led by Emmanuel Flurin, is a continuation of this research. "*We wanted to develop new generations of photon counters capable of achieving sufficient sensitivity to detect an individual electron spin.*" This would open up applications in quantum computing. The work will move to electron spins of erbium (Er^{3+}) ions in tungsten oxide crystal, for which the team recently observed coherence times of 23 ms. "*If we can manipulate an individual electron spin, we can also manipulate nuclear spins, whose coherence times are potentially even longer.*"

Publication • Albertinale, E. *et al.* Detecting spins by their fluorescence with a microwave photon counter. *Nature* 600, 434–438 (2021).

Title

Oncology at Université Paris-Saclay



LABORATORIES:

1 – BECCOH (UPSaclay, UVSQ)
2 – BioCIS (UPSaclay, CNRS, Univ. Cergy-Pontoise)
3 – BIOMAPS (UPSaclay, CEA, CNRS, Inserm)
4 – CCT (UPSaclay)
5 – CESP (UPSaclay, UVSQ, Inserm)
6 – CMBC (UPSaclay, CNRS, Inserm, Institut Curie)
7 – CSHMyelo (UPSaclay, Gustave Roussy, Inserm)
8 – DYNAMO (UPSaclay, Inserm, Gustave Roussy)
9 – GABI (UPSaclay, INRAE, AgroParisTech)
10 – GIRC (UPSaclay, CNRS, Institut Curie),
11 – HEPAREG (UPSaclay, Inserm)
12 – I2BC (UPSaclay, CEA, CNRS)
13 – IBISC (UPSaclay, Univ. d'Évry)
14 – ICMMO (UPSaclay, CNRS)
15 – ICP (UPSaclay, CNRS)
16 – ICSN (UPSaclay, CNRS)
17 – IGC (UPSaclay, Gustave Roussy, CNRS),
18 – IGPS (UPSaclay, CNRS)
19 – IJCLab (UPSaclay, CNRS, Univ. Paris Cité)
20 – ILV (UPSaclay, UVSQ)
21 – IMVA-HB (UPSaclay, Inserm, CEA)
22 – INTEGRARE (UPSaclay, Univ. d'Évry, Inserm, Généthon, EPHE)
23 – INTIM (UPSaclay, Gustave Roussy, Inserm, EPHE)
24 – IPSIT (UPSaclay, Inserm, CNRS)
25 – ISMO (UPSaclay, CNRS)
26 – I-STEM (UPSaclay, Inserm, Univ. d'Évry)
27 – ITIC (UPSaclay, Gustave Roussy, Inserm)
28 – LAMBE (UPSaclay, Univ. d'Évry, CNRS, Univ. Cergy-Pontoise)
29 – LBPA (UPSaclay, ENS Paris-Saclay, CNRS)
30 – LGBC (UPSaclay, UVSQ)
31 – Lip(Sys)2 (UPSaclay), à Châtenay-Malabry
32 –LITO (UPSaclay, PSL Université, Institut Curie, Inserm)
33 – LPS (UPSaclay, CNRS)
34 – LuMin (UPSaclay, ENS Paris-Saclay, CNRS, CentraleSupélec)
35 – METSY (UPSaclay, CNRS, Gustave Roussy)
36 – MI2 (UPSaclay, Inserm)
37 – MICALIS (UPSaclay, INRAE, AgroParisTech)
38 – MICS (UPSaclay, CentraleSupélec)
39 – MIRCen (UPSaclay, CEA)
40 – MS (UPSaclay),
41 – MTS (UPSaclay, CEA, INRAE)
42 – Neuro-PSI (UPSaclay, CNRS)
43 – NeuroSpin (UPSaclay, CEA)
44 – NIMBE (UPSaclay, CEA, CNRS)
45 – ONCOSTEM (UPSaclay, Inserm)
46 – PHYSENDO (UPSaclay, Inserm)
47 – PMNCO (UPSaclay, Gustave Roussy, Inserm)
48 – RaMO-IT (UPSaclay, Gustave Roussy, Inserm)
49 – RETRO-ENDO (UPSaclay, CNRS, Gustave Roussy)
50 – SABNP (UPSaclay, Inserm, Univ. d'Évry)
51 – SGCSR (UPSaclay, Inserm, CEA, Univ. Paris Cité)
52 – SRC (UPSaclay, Inserm, CNRS, Institut Curie)
53 – SToRM (UPSaclay, Inserm, SSA),
54 – TCD (UPSaclay, Gustave Roussy, Inserm)

200
researchers

150
lecturers

100
hospital practitioners

130
engineers, technicians and administrative staff

Main research areas:

— Targets, ligands and therapeutic molecules
— Molecular probes, metabolites and biomarkers
— Formulation, addressing, vectorization, galenics, biomaterials
— Stem cells, cell and gene therapies
— Immunity, inflammation and infection
— Cancer
— Physiopathology of the hepatobiliary system
— Innovative therapies: access, personalised medicine, evaluation and patient care

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• School of Cancer Sciences
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• LivingMachines @Work
• MétabioDivex
• BioProbe

A few start-ups created:

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— Elikya Therapeutics
— Elyssamed
— Everimmune
— Findimmune
— Graegis Therapeutics
— Ribonexus
— TheraPanacea
— VitaDX

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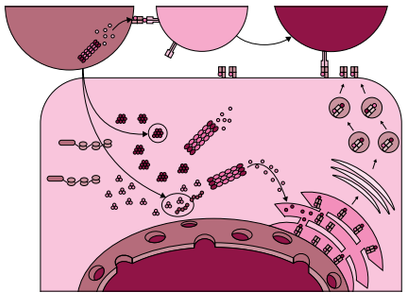
— Therapeutic Innovation, from Fundamental to Applied (ITFA)
— Public Health
— Signals and Integrative Networks in Biology (BIOSIGNE)
— Structure and Dynamics of Living Systems (SDSV)

Elikya Therapeutics and PTPs-VAC: therapeutic innovation in immuno-oncology



Mouad Alami, director of the Biomolecules: Design, Isolation, Synthesis Laboratory (BioCIS – Univ. Paris-Saclay, CNRS, Univ. Cergy-Pontoise) and Sébastien Apcher, a researcher at the Tumour Immunology and Cancer Immunotherapy Unit (ITIC – Univ. Paris-Saclay, Gustave Roussy, Inserm) co-founded the biotechnology start-up Elikya Therapeutics in December 2021. Its focus is on discovering new drugs and is involved in providing next generation clinical trials following a portfolio of four patents filed by Université Paris-Saclay, Gustave Roussy and CNRS Innovation. Mouad Alami explains, "*We're developing small molecules to meet specific needs in this area.*" In addition, Sébastien Apcher is leading the PTPs-VAC project which is focusing on the design of new peptide-based cancer vaccines. He explains, *"This work is supported by SATT Paris-Saclay and a new patent is being prepared to co-found a new start-up.*"

Findimmune: anti-cancer and immuno-therapy treatments

The biopharmaceutical start-up Findimmune has developed three new combinations of treatments to facilitate patient access to anti-cancer and immunotherapy treatments. They are based on the study of fundamental mechanisms and the identification of about twenty molecules selected for their capacity to increase the effects of radiotherapy and to stimulate the immune system. The start-up, which is a spin off from Gustave Roussy and is supported by SATT Paris-Saclay, has been co-founded by Éric Deutsch, a professor, hospital practitioner in radiotherapy and Joint Director of the Molecular Radiotherapy and Therapeutic Innovation unit (RaMo-IT – Univ. Paris-Saclay, Gustave Roussy, Inserm); Angelo Paci, a professor in Pharmacology at the Faculty of Pharmacy at Université Paris-Saclay and Manager of the Pharmacology Department at Gustave Roussy; Jean-Luc Perfettini, a Director of Research at Inserm and the Joint Director of RaMo-IT and the entrepreneur Guillaume Brion. "*Thanks to our combined expertise, we have designed an innovative platform for the discovery of new drug candidates and are delighted with the interest it has already received from several pharmaceutical companies,*" says Jean-Luc Perfettini.

https://www.findimmune.com/

TheraPanacea: improving cancer treatments using AI

The start-up TheraPanacea, which is the result of over fifteen years of research at CentraleSupélec and Inria in partnership with the Gustave Roussy Institute, came into being in 2017. Founded and managed by Nikos Paragios, a professor in Applied Mathematics at CentraleSupélec, it offers a solution for optimising cancer care through the use of mathematics, physics, artificial intelligence and treatment data. Its ART-Plan software package produces a 3D digital twin of the patient, tracks the patient's anatomical development and allows doctors to suggest the best course of radiation therapy. "*The most important factors in the fight against cancer are quality of care and time. We enable doctors to offer the best treatments to patients and to start these treatments earlier by saving up to 95% of the time usually spent preparing the treatment plan.*"

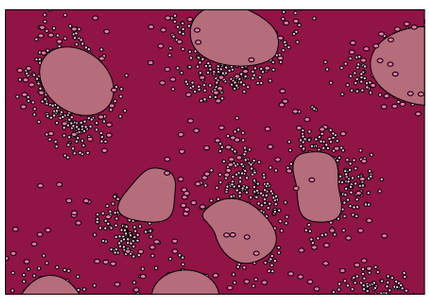
https://www.therapanacea.eu/

Award-winning medical imaging processing solution

André Guerassimov, a student in his final year at CentraleSupélec and an Entrepreneurship and Innovative Project Management Master's student at Université Paris-Saclay; Tanel Petelot, a student in his 2nd year at CentraleSupélec and Manon Pietrantoni, who is studying a joint degree at ENS Paris-Saclay and a Biology and Health Master's degree at Université Paris-Saclay won, with congratulations from the judges, the Challenge Start-Up last November for their Quanteam project. This award is given by Université Paris-Saclay. The prize, an immersive stay in Silicon Valley, is for their project to develop an innovative post-processing solution using algorithms for medical imaging. "*The aim is to help doctors in clinical practice to better identify the cancer by providing them with highly sophisticated image processing tools which are currently only used in the research world*," explains Manon Pietrantoni. This solution, which was developed based on the PhD work of Florent Besson, a nuclear radiologist and lecturer at the Paris-Saclay university hospitals, and Sylvain Faure, a research engineer at the Laboratory of Mathematics, Orsay (LMO – Univ. Paris-Saclay, CNRS) could soon be the focus of a start-up.

https://www.universite-paris-saclay.fr/actualites/challenge-startup-2021-direction-la-silicon-valley-pour-8-projets-de-startup

Ribonexus: overcoming resistance to cancer treatments

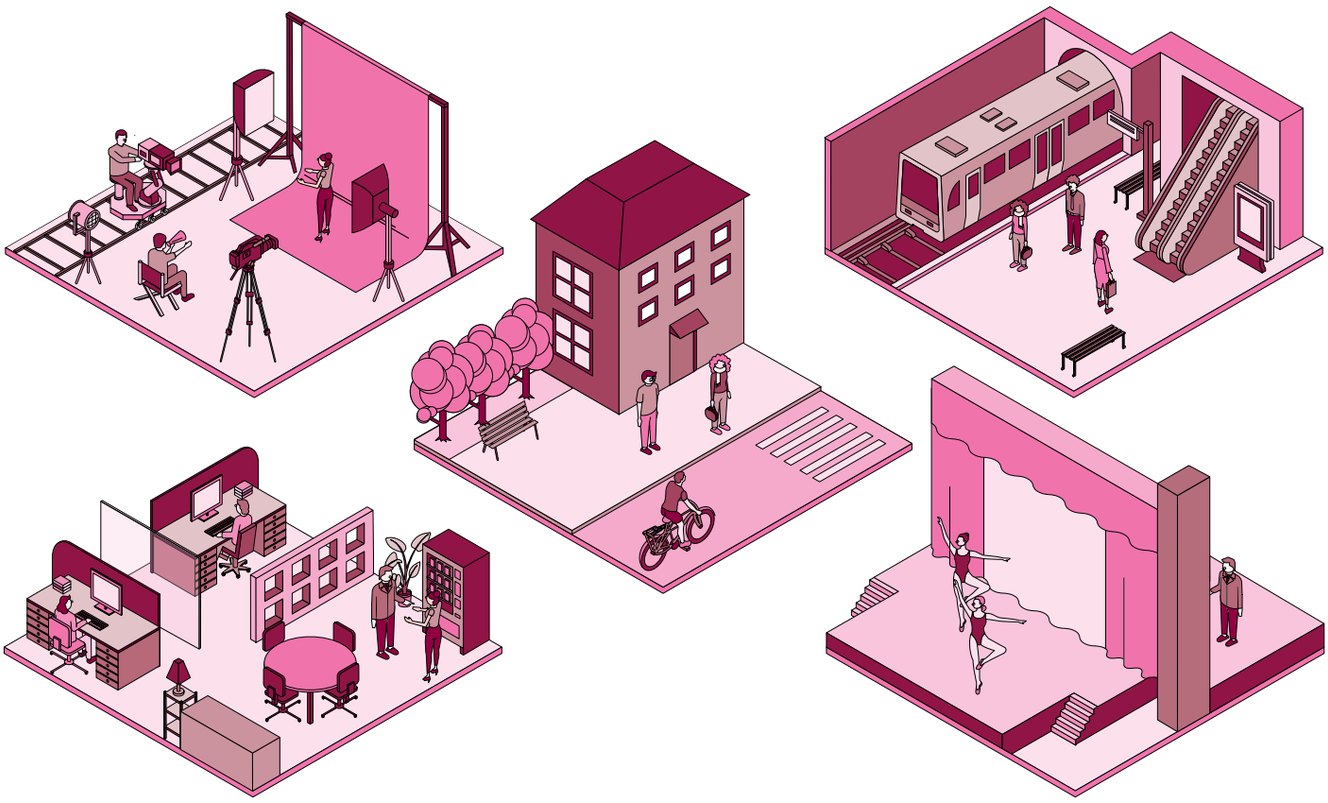


The Ribonexus biotechnology start-up came into being in the summer of 2021. It brings together translational and basic research and aims to develop new treatments to counteract therapy resistance in cancer patients. "*We work with the mechanism of plasticity which controls the messenger RNA in translation, a biological parameter which hasn't been explored much in the therapeutic field,*" explains Stéphan Vagner, the co-founder of Ribonexus and a researcher at and director of the Genome Integrity, RNA and Cancer Laboratory (GIRC – Univ. Paris-Saclay, CNRS, Institut Curie). Thanks to a €4 million funding round from investors and a licensing agreement with Pierre Fabre for a series of small molecules targeting the eIF4A protein involved in the mechanism, "*We can now put into practice more than ten years of research and the shared expertise of our two laboratories,*" says Caroline Robert, co-founder of the start-up and a researcher at the Molecular Predictors and New Targets in Oncology Laboratory (PMNCO – Univ. Paris-Saclay, Institut Gustave Roussy, Inserm).

Keywords
Historicisation of sexual harassment

Title

If sexual harassment were told to us



The historicisation of sexual harassment is the focus of the Avisa project which is opening a window on past written, pictorial, narrative and cinematographic representations of this social problem with the aim of stamping it out more effectively today.

On 5 October 2017, an upswell of complaints began in the American film industry. In several newspapers and across social media, nearly one hundred women, including several renowned actors, reported the violence and sexual assaults they had suffered at the hands of Hollywood producer, Harvey Weinstein. The MeToo movement, which was started in 2007 by the African American social worker and activist Tarana Burke in order to expose sexual and gender-based violence against minority women, gathered pace in the following months. Women in several countries started to organise themselves and march to demand more punishment for abusers and to stop sexual violence, including sexual harassment. A tidal wave of #MeToo inundated social media networks and in France denouncements were made using the hashtag #BalanceTonPorc. It was an historical moment. It liberated victims' voices across all sectors of business. "*Although sexual harassment became more visible after the #MeToo movement, it's nothing new – even though this offence has only become part of law relatively recently,*" points out Armel Dubois-Nayt, a specialist in British Civilisation and the History of Ideas at the Heritage and Cultural Dynamics Laboratory (DYPAC – Univ. Paris-Saclay, UVSQ) and co-leader of the 'Avisa – Historicising Sexual Harassment' project.

However, the world seemed to be finally becoming aware of the extent of this scourge plaguing our societies. In October 2019, an IFOP (French Institute for Public Opinion) survey for the Jean-Jaurès Foundation and the Foundation for European Progressive Studies conducted in April 2019 using a sample of over 5,000 women from 5 countries in the European Union (Germany, Spain, France, Italy and the United Kingdom) representative of the female population aged 18 and over, revealed that 60% of the European women asked had already experienced some form of sexual harassment at work during their professional lives, and 21% of these had experienced it during the last twelve months. 65% of women had experienced at least one form of sexual assault or abuse on the street. This figure rose to 86% for French women. As a result, sexual harassment was shown to be a ubiquitous social fact and any strategy to combat it would involve going back to the origins of the problem. However, the history of sexual harassment still remains relatively unknown.

Historicising sexual harassment: a long-term project

The Avisa project started in 2020 thanks to Émergence funding from MSH Paris-Saclay. The project aims to bring to light other periods in the past when women and men have been subjected to acts of sexual harassment which they have sometimes denounced or fought legally or symbolically. The goal is to demonstrate that sexual harassment was reported long before the Weinstein affair, that it was condemned without necessarily being tried in court and that cases of sexual harassment are well documented.

The project, which takes its name from an English narrative poem dating from 1594 where the main female character successively repels the violent assaults of several suitors, brings

together some thirty individuals from around fifteen European universities. Linguists, civilisationists, historians, film and audiovisual sociologists, specialists in literature, the history of ideas, arts and artistic practices, etc. are working together to shed light on the history of written, pictorial, narrative or cinematographic representations of sexual harassment in the West, from the Middle Ages to the present day. "*The challenge is working with an interdisciplinary approach and getting people with different skills to interact on this subject,*" points out Réjane Vallée, a film sociologist from the Pierre Naville Centre (CPN – Univ. Paris-Saclay, Univ. d'Évry), and co-leader of the Avisa project.

The valuable results from this collective research project are being fed into a bilingual digital platform which will eventually record the way in which these abuses have been reported and denounced. This platform will also contain a list of victims, whether they are historical, real or fictional people. "*It will show their names, the evidence of the harassment and the source in which it was found,*" explains Armel Dubois-Nayt. In conclusion, a real socio-historical map of where sexual harassment has taken place should emerge. "*By mapping our findings, we want to see if geographical areas or time periods emerge where the problem has been particularly acute.*" The project is only focusing on female victims for the moment. "*We wanted to start with one type of harassment first, before looking into others,*" explains Réjane Vallée.

The pandemic has meant that, up until now, Avisa has taken place remotely in the form of webinars. The first of the project's conferences, entitled 'Writing the History of Sexual Harassment over the Long Term: Naming, Denouncing, Representing, Putting into Images or into Music' took place on 9 and 10 of December 2021. It was a chance for participants to agree on a common methodology for uncovering references to sexual violence in history and for tackling the texts, films and artworks which depict it. Some of the participants explained how this type of behaviour has been put into scenes and words in literary works or fiction (serials, films), or how it has been denounced, in order to better challenge it. Others had chosen to give a voice to women who have been victims of such acts and whose testimonies come from the worlds of dance, opera and film. These are all factors which will feed discussions for the rest of the project.

The same term but different definitions

To begin with, the team set out to clarify the definition of what we now call 'sexual harassment'. "*As the term is recent in usage, is it possible to use it to describe facts and events which took place in earlier periods? Wouldn't that be anachronistic? Are there any other words which describe this type of behaviour?*" asks Armel Dubois-Nayt.

Sexual harassment was defined in the French Penal Code, Article 222-33 of Law No.°92-684 of 22 July 1992. Revised in 2018 by law No.°2018-703 to strengthen the fight against sexual and gender-based violence, the definition now refers to "*repeatedly imposing on a person comments or behaviour with sexual or sexist connotations which either violate his or her dignity because of their degrading or humiliating nature, or create an intimidating, hostile or offensive situation.*"

The English definition of sexual harassment does not imply repetition of the act. "*Just once is enough,*" points out Armel Dubois-Nayt. For UN Women, the UN body dedicated to gender equality and women's empowerment, sexual harassment "*refers to highly suggestive behaviour involving non-consensual physical contact, touching, pinching, rubbing with sexual connotations against another person's body. It may also refer to behaviours which are not directly physical, such as whistling, sexual comments about a person's body or appearance, requests for sexual favours, sustained looks and staring at any other person, following or watching them, or acts of exhibitionism.*"

In view of this diverse range of definitions, the broad time scale and the diversity of geographical areas covered by the Avisa project, the team has decided to look at sexual harassment outside of any legal framework. "*We decided to bring together the French, English and European definitions,*" says Armel Dubois-Nayt.

The first indirect references

It is not easy to trace the first references to sexual harassment in history. "*It can be said that at the very least the word 'harassment' was used in French in an idyl written by Jean Vauquelin de la Fresnaye which was published in 1605,*" points out Armel Dubois-Nayt. "*Chloé Tardivel, who is also involved in the project, has found references to sexual harassment in court cases in Bologna, Italy, at the end of the 14th century.*" Did such cases result in complaints to the courts or convictions? "*One of the precise aims of Avisa is to find out how such complaints reached the courts. However, it's clear that until the beginning of the 20th century, this was always done indirectly. Legal action was taken for other reasons, and it was only in the course of the investigation that it became apparent that sexual harassment occurred. For example, if a man filed a complaint against a woman for slapping him and then later it became clear she did it because he was harassing her. It was only in the second half of the 20th century that women started filing complaints directly,*" explains Armel Dubois-Nayt. "*In addition, the class system remained very rigid until the 20th century, so stories of sexual harassment could only be found between people of the same class. Later, there were cases of servants lodging complaints against masters, something which would have been unthinkable under the Ancien Régime, especially if the master was an aristocrat.*"

Some national or cultural particularities are also addressed within the Avisa project, including how sexual harassment is justified or explained. At the moment, the geographical area covered by the project is essentially European and includes France, Britain, Spain and Italy, as well as a few forays into the north of the United States because of Hollywood. "*The focus is really on the West. However, we plan to extend our study into India in particular so that we can examine Bollywood cinema and its treatment of male-female relations,*" points out Réjane Vallée.

After all, the history of sexual harassment and its manifestations is also a way of questioning relationships between the sexes, how this has changed and the status of women. Medieval painted ceilings, studied by historians Delphine Grenet and Maud Perez Simon, provide some good insights into this. These decorative features found in the grand homes of the urban elite during the 14th and 15th centuries depict scenes of a quite diverse nature. The so-called 'courtly' ones show men and women interacting. "*Some of these scenes have strong sexual connotations and can clearly be seen as sexual harassment,*" comments Armel Dubois-Nayt. The kisses, touching and forced, intrusive gestures depicted on the part of the men is questionable behaviour. "*However, historical interpretations have still used the term 'courtly'.*" How then can we explain the presence of such a ceiling in the domestic interior of a stately home in the Middle Ages? Why are such scenes depicted and for whom were they intended? There are two possible interpretations. "*They could have been a message intended for the young women and servants of the house that they needed to be careful around men and should remain virtuous. Or, they could have been aimed at the boys in the house in that they conveyed an image of masculinity where sexual harassment was cast in a favourable light,*" suggests Armel Dubois-Nayt. Depending on which interpretation is preferred – a warning or a trivialisation of sexual violence – "*This would mean that sexual*

harassment was part of the social interaction between the sexes at certain times."

The problematic role played by the Arts

Literature, as well as art, also has an ambiguous relationship with sexual harassment. This can be seen in pastorals, which were a type of poem popular in the Middle Ages. "*This literary tradition features a knight or a prince who tries to seduce a young peasant girl or a shepherdess – two characters portraying a hierarchical social relationship. The young woman refuses any advances or contact made by the man,*" says Armel Dubois-Nayt. Is it all a pretence or is the refusal genuine? There are two opposing interpretations here too. The first argues that this is a literary convention in which the young woman's rejection can only be a pretence in order to conform to the codes of honour at the time, according to which a woman couldn't say 'yes' to a man's advances, even if she liked him. The second supports a more current reading of the scene in that it should be reinterpreted as sexual harassment.

Other art forms are also not immune. "*Generally speaking, artistic professions where the relationship with the body is important are affected by sexual harassment. The body, which is the working tool of women, is exposed to the gaze of men and this makes them particularly vulnerable,*" explains Armel Dubois-Nayt. Dancers, for example, at the end of the 19th century and at the start of the 20th century were specific targets. "*Based on women's own accounts, Hélène Marquié (who is part of the Avisa project), has traced the dancers' journey from the dressing room to the stage and shown the opportunities men took to touch and harass them,*" says Armel Dubois-Nayt. They allowed themselves this liberty because, according to the mores of the era, the profession was associated with prostitution. "*Dancers faced a lack of respect and so the fact that they were being harassed became less reprehensible. It became 'almost' part of the job.*"

Other artists, such as opera singers, were also targets for sexual harassment, as Caroline Giron-Panel explains. "*Here, too, women have been particularly harassed, both in the course of their work and in opera librettos, which repeatedly contained scenes of sexual harassment.*" It must be remembered that the vast majority of 19th century operas had a love triangle as the plot, played out by a soprano, a tenor and a baritone. And, as the writer and music critic Georges Bernard Shaw pointed out, "*Opera is about a soprano and a tenor who want to sleep together and a baritone who tries to prevent them from doing so.*"

The rise of harassment on the street

Women's work, which had so long been in the home, expanded in the 19th century into factories and industry. These were perfect examples of places where the genders mixed, and women came face to face with sexual harassment here. The historian, Anaïs Albert has analysed the archives of minutes from the Paris Labour Relations Court (Les Prudhommes de Paris) from 1850 to 1890 where she focused on the work of young female apprentices in the textile industry. "*She found cases where parents filed a complaint in order to end their daughter's apprenticeship contract because they felt that she was being sexually harassed,*" says Armel Dubois-Nayt. Her study points to distinct situations of sexual harassment and acts of abusive language with sexual connotations. "*These situations both arose from bosses who insulted their apprentices by using sexual language and from the environment in which the apprentices lived where employees talked about sex excessively.*" The historian found cases of sexual harassment involving propositions, invitations, unwanted touching and intrusions by the boss into the apprentice's bedroom, who was staying in his home. The Paris Labour Relations Court archives (and others) also revealed the harassment on the street suffered by these young apprentices and female milliners, clothing or hat designers. "*They had to shop for their boss, so had to walk through the streets of Paris. They were preyed upon by 'stalkers' who followed them and harassed them,*" points out Armel Dubois-Nayt.

With the arrival of cinematography in 1885, the character of the 'stalker' already present in the press and in books at the end of the 19th century, took on a new dimension. "*The cinema drew its inspiration from this and used the same concept, i.e. a woman pursued by one or more 'suitors' in the streets as she walks along,*" explains Réjane Vallée. However, this character has become slapstick and a source of comedy. The 'stalker' makes people laugh at his own expense. The audience finds the failure of his attempts funny, without feeling any empathy for the young woman harassed and victimised by the 'stalker'.

The recent reappraisal of film

Was the world of cinema trivialising sexual harassment, or was it just reflecting an accepted banalization by many societies? "*The poster for the French comedy 'Promotion Canapé', released in 1990, included the phrase 'Sexual harassment exists, we've been there and done that'*," points out Réjane Vallée. Similarly, in the American comedy There's Something About Mary, which was released in 1998, no one at the time was concerned about the sexual harassment of Mary by several men. "*However, this type of thing has changed radically,*" says Réjane Vallée. "*It wouldn't be conceivable to produce such films today. On the contrary, there are more and more films about trials and investigations into sexual harassment.*"

As Olivier Caira shows, the treatment of female characters in films in the James Bond franchise illustrates this change. "*To begin with, the posters showed a plethora of frequently naked young women. This has become less and less the case until, in the most recent ones, you don't see women at all,*" says Réjane Vallée. "*And, depending on the social class of the female character (a hotel receptionist or scientist, for example), the sexual harassment displayed by James Bond was accepted in varying degrees by the viewer.*" However, what was acceptable to viewers in the 1960s was not acceptable to viewers in 2010. "*The question of sexual harassment and films is obviously a question of context and era.*"

And the post-Weinstein era has also been affected. "*Initially, we wanted to stop at this case, but we found that we had to go beyond it in some instances,*" says Réjane Vallée. "*For example, in the series Orange is the New Black, Jessica Jimeno perceived a change after this affair. The technical teams include more women and the last two seasons have a completely different approach in that the scripts now take revenge on the harasser.*"

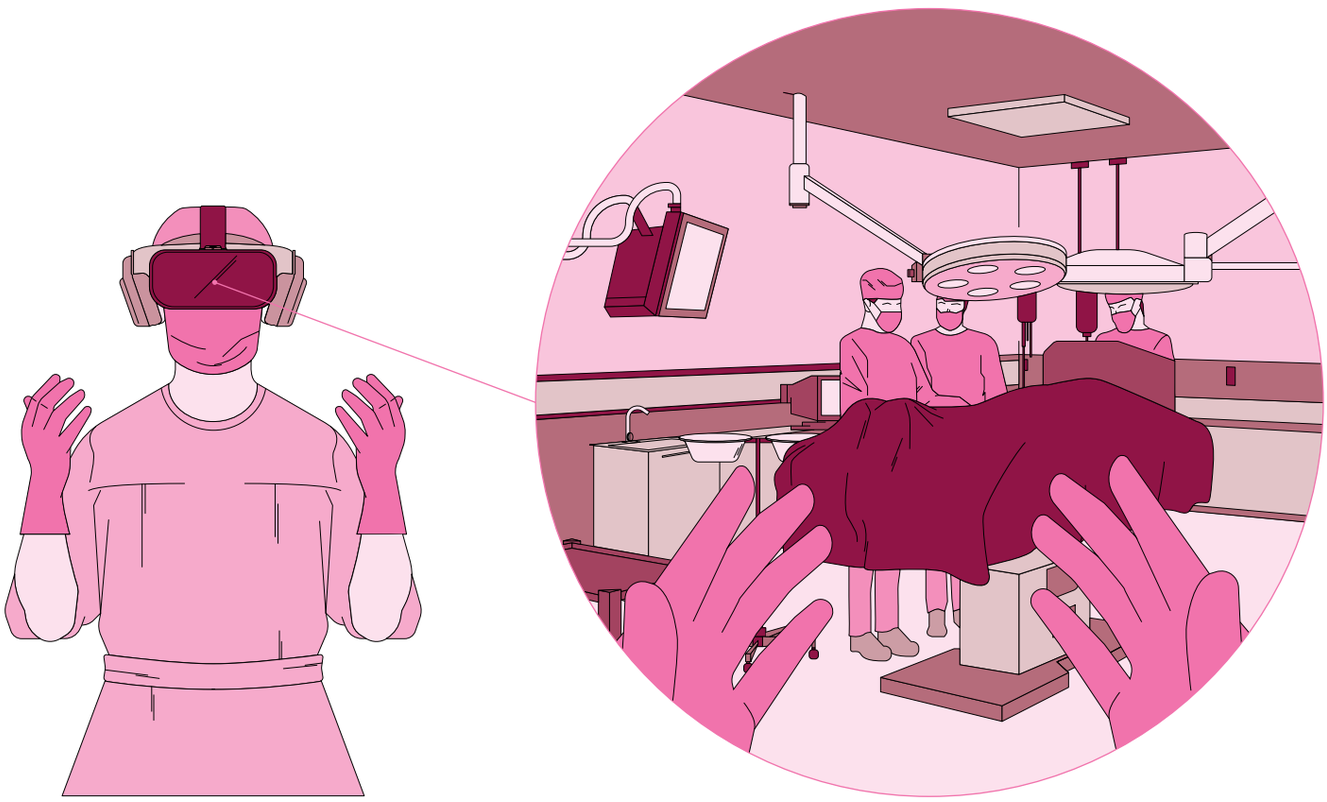
So that this important work can continue, MSH Paris-Saclay has recently granted the project new funding. Two workshops are already planned in 2022 – one in June and another in September. However, given the scope of the work, the whole team is looking far ahead. "*We hope to create a snowball effect and encourage other researchers to become involved in this under-researched area,*" says Armel Dubois-Nayt in conclusion.

https://avisa.huma-num.fr/s/avisa/page/accueil

Keywords
Augmented reality and virtual reality

Title

The development of augmented reality and virtual reality in health



Often confined to the realms of video games or science fiction stories, augmented reality and virtual reality have a huge range of possible applications, particularly in the future of medicine. Researchers at Université Paris-Saclay are considering a number of trials for these technologies.

Augmented reality (AR) offers the opportunity to superimpose virtual elements on a real field of vision through the use of devices (headsets, glasses, etc.). Virtual reality (VR) immerses users in an entirely virtual world, often with the help of an integrated headset. These technologies, both of which are more than 50 years old, have experienced spectacular growth recently. Virtual reality headsets are increasingly being marketed by the entertainment giants (Oculus Quest by Meta, Playstation VR by Sony, etc.) who are aiming to design ever-increasing immersive video games, or even enter the metaverse (an entirely virtual world). Augmented reality glasses have been just as attractive to the world's largest multinationals (HoloLens by Microsoft or Google Glasses in particular) with varying degrees of success. However, beyond video games and the metaverse, some of the applications for these technologies are currently revolutionising other areas of society.

Augmented reality and virtual reality for use in medicine

Imagine entirely reconstructed operating theatres in the virtual world where student surgeons test their medical skills. After being trained in virtual reality, these same surgeons move to an operating theatre where augmented reality assists them throughout their operation. This is the bold ambition of the BOPA chair (which stands for 'Bloc opératoire augmenté' or augmented operating room). This chair, which is the result of a partnership between the AP-HP, Institut Mines-Télécom, Université Paris-Saclay, Inria Saclay and the 'Conservatoire national des arts et métiers' (National Conservatory of Arts and Crafts) or Cnam, aims to transform the analysis and learning of surgical procedures by introducing technologies such as augmented reality and virtual reality into medical training and practice.

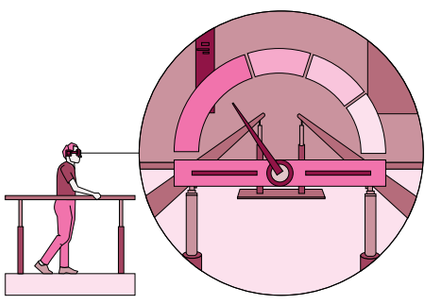
How to use these two tools to benefit medicine is also studied at the Computer Science, Bio-informatics and Complex Systems Laboratory (IBISC – Univ. Paris-Saclay, Univ. d'Évry). "*In the medical education sector, current technologies, including VR, are well placed to provide improved solutions,*" explains Samir Otmane, who leads the Augmented Reality & Ambient Robotics Interaction (IRA^2) team at IBISC. This team tries to reconstruct training in virtual reality as faithfully as possible in order to practise medicine. In addition, these scientists have already developed bimanual manipulation exercises in virtual reality and a fully-fledged simulator for locoregional anaesthesia. Connected to a computer and a VR headset, an operation on a virtual patient is started with the help of a device featuring fake surgical forceps, for example.

According to Samir Otmane, the main issue preventing the use of VR has long been a lack of accuracy in the reproduction of technical hand gestures. Virtual simulators simply did not offer a high enough degree of realism for them to serve as a suitable context for medical training. Today, as his team's work shows, medical training using VR is now possible.

The advantages offered by VR in the field of medical training are many. First of all, as the

researcher explains, there is a "*need for technological tools to improve medical training. Simulation-based training has acquired an important place since the reform in 2018 of the third cycle of medical studies.*" Surgical simulation training is now carried out on artificial organs, limbs and dummies. This represents a significant cost, which has the potential to be reduced by incorporating VR into medical simulation training methods.

Using AR and VR for patients rehabilitation



In addition to medical training, augmented reality and virtual reality are also set to revolutionise the rehabilitation of patients. The IRA² team at IBISC is focusing on people with movement disorders. "*The situation is clear as far as rehabilitation is concerned. The number of people is constantly increasing and there's a lack of human resources to deal with them. It's very difficult to access care quickly in some regions of France,*" laments Samir Otmane. "*One of the issues we've tried to answer is can we provide new complementary tools which can be used independently by patients and at home?*"

In their recent work with the Ellen Poidatz foundation, researchers from the IRA² team have been focusing on walking rehabilitation techniques for children with cerebral palsy. Using an augmented reality headset, they can play a 'serious game' (an activity which combines fun with a serious purpose) which involves walking as quickly as possible behind a small character who encourages them on. The results of the games are then analysed so that patients can make progress in their rehabilitation at their own speed.

Samir Otmane's team are also developing other 'serious games' to support the rehabilitation of upper limbs in stroke patients. Using AR and VR, it is possible to offer treatment involving a traditional follow-up in hospital and an 'independent treatment' which can be used at home. This involves an augmented reality or virtual reality headset, or just a computer equipped with hand movement detectors. The advantages of this combination are numerous. First and foremost, the independent exercises speed up the rehabilitation process. It is important to start this as soon as possible after a stroke. However, motivation is also an important factor. "*We're particularly interested in children. They don't really respond well to the usual walking rehabilitation techniques. However, they're keen on play,*" points out Samir Otmane.

Within the Complexity, Innovation, Motor and Sports Activities laboratory (CIAMS – Univ. Paris-Saclay, Univ. d'Orléans), this includes animated virtual characters with facial expressions to study empathetic reactions in response to the emotion expressed by the character. In this way, according to Aurore Meugnot, it is possible "*to use virtual reality to learn about empathy.*" In her recent research, this specialist in cognitive and affective neuroscience has shown that tiny movements "*which we often don't pay much attention to, like blinking or changes in posture*" increase the quality of interaction and elicit more emotions from the observer, including a better empathic response. "*The challenge is not so much to add realism to the features of a virtual avatar, but rather to improve the empathetic reaction to the avatar,*" adds the researcher. In this way, interactions using VR have the advantage of offering patients with impaired empathy, such as children with autism spectrum disorders (ASD), an additional form of therapy. However, there is no real scientific evidence that children find it easier to interact with a virtual character than with a human being. "*What we do know is that children find it easier to enter an imaginary world,*" points out Aurore Meugnot.

Valentin Bauer, a PhD student working at the Interdisciplinary Laboratory of Digital Sciences (LISN – Univ Paris-Saclay, CNRS, Inria, CentraleSupélec) has become interested in the creation of multi-sensory platforms which use AR and VR. The aim of these new tools is to improve the care of children with ASD. Supported by associate professor Tifanie Bouchara, Valentin Bauer is particularly interested in the contribution audio makes to virtual immersion. "*The audio aspect in this new medium of virtual reality is not as well developed as the graphics,*" explains Tifanie Bouchara. The two researchers at LISN, who both have a background in engineering, have developed an augmented reality tool capable of interacting in real time with a piece of music directly linked to an immersive graphic representation. This will lead, in the future, to the creation of a multisensory serious game combining auditory and visual experiences.

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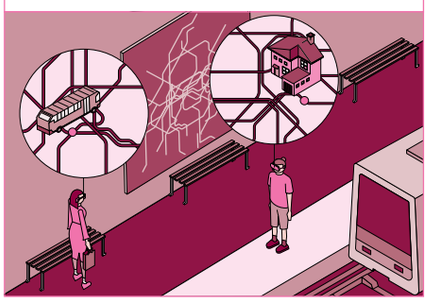
Title

Mixed reality: other future possibilities for augmented reality and virtual reality



Mixed reality is often the term used to describe the combined use of augmented reality (AR) and virtual reality (VR). This technology, which allows users to control personalised panels displayed in real time without having to lift a finger, is of interest in many areas of research, from food to crisis management. How are scientists at Université Paris-Saclay developing such tools?

In the Paris-Saclay Food and Bioproduct Engineering laboratory (SayFood – Univ. Paris-Saclay, INRAE, AgroParisTech), David Blumenthal and his colleagues are investigating the use of VR in the food product development process. The Human/Food Interactions for Development team (IHAC), which he manages, uses virtual reality as a fully controlled environment to ensure that the consumer experience is as close to reality as possible. "*VR cuts out the influence of the environment when testing,*" explains David Blumenthal. In this case, virtual reality is used at the very centre of consumer satisfaction analyses when developing and evaluating products.

Augmented reality... above a screen

At the Interdisciplinary Laboratory of Digital Sciences (LISN – Univ Paris-Saclay, CNRS, Inria, CentraleSupélec), VR headsets and AR glasses can be counted in their dozens. Supervised by Olivier Chapuis, the Human Interaction hub (IaH) at the laboratory is at the root of a lot of work dealing with augmented reality. One example shows how to superimpose personalised information on a split screen using an augmented reality device. "*The display options are increased with the addition of more space. Our aim is not so much to create a bigger screen, but to create new, different and user-manageable spaces,*" explains Raphaël James, a PhD student working in the team. So, although everyone is looking at the same map, they each get a personalised route which only they can see. "*The example is where each person has a different route to take which you would like to show on a common map. However, you of course would not want to project or broadcast this personal information on the screen. The idea is ultimately to make these displays customizable,*" explains Olivier Chapuis. This context also raises the issue of simplifying maps. There is a need to make them easier to read for everyone, while obtaining detailed information using AR devices, but without inconveniencing other users.

Olivier Chapuis' team is not only thinking about applications involving maps of public transport networks or walking routes. "*Our field of application includes control rooms and crisis management rooms. The people there have different roles. There are firemen, police, people in charge of traffic control, etc. All these people have to work together. The idea would be, for example, to have a map of a town shared by everyone and including personal information provided via augmented reality in accordance with each person's role.*"

Mixed reality at the heart of changes in society

Then there is the question of the screen and its place in a world using AR or VR. "*When we started our work, we didn't know if it was possible to do AR above a screen,*" admit Olivier Chapuis and Raphaël James. "*However, research generally speaking is now increasingly going in this direction.*" Emmanuel Pietriga's team, which is also working at LISN, has been studying how to combine a smartphone with an augmented reality device, including traditional applications which can project control panels 'beyond' the phone to simplify the display. "*Even when using your computer screen or smartphone, you sometimes need more display and more space,*" sums up Olivier Chapuis.

But, with devices such as these capable of projecting an unlimited number of displays into the void, won't the use of smartphones or screens become obsolete? "*Not at all,*" say Raphaël James and Olivier Chapuis in reply. "*You soon realise that it doesn't work without a physical screen. There are several scientific papers which show that it's always better to have a physical device on which to base your interactions.*"

Looking beyond the simple, fun use made of them today, augmented reality and virtual reality may still only be used for very specific applications before being accessible to the whole of society. Making AR accessible to everyone raises several questions, as Olivier Chapuis points out. "*I personally think that augmented reality raises a lot of issues for society in general. With a pair of AR glasses, you could take pictures without anyone noticing, and then make video or audio recordings,*" the researcher at LISN worries. "*In the public sphere, this really is a problem. When you do research, you must also question yourself about the consequences of your work.*"

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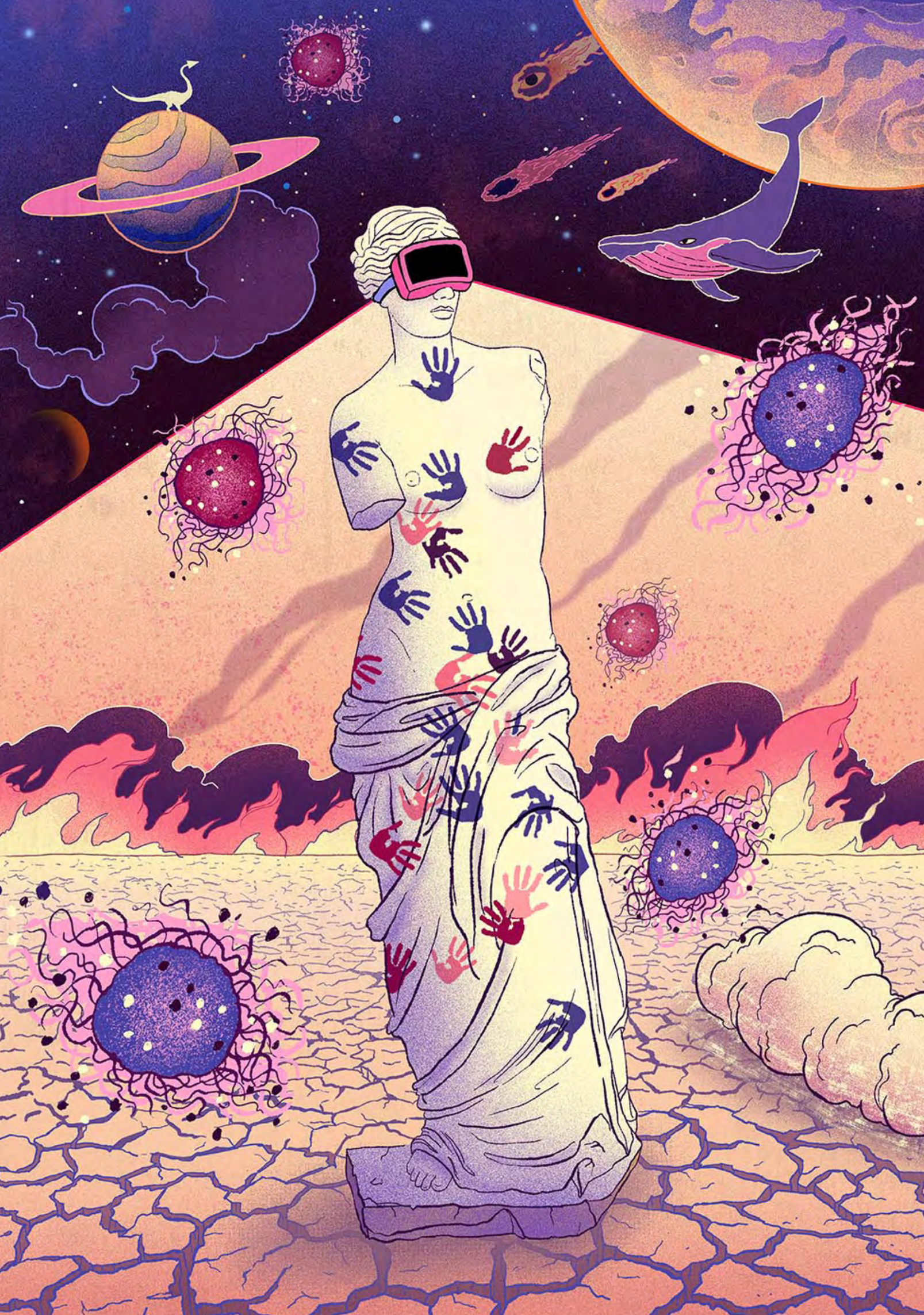
- James R. *et al.* Personal+Context navigation: combining AR and shared displays in Network Path-following. GI 2020 – *Conference on Graphics Interface*, 2020.
- Brasier E. *et al.* AR-enhanced Widgets for Smartphone-centric Interaction. *Proceedings of Mobile HCI 2021 – ACM International Conference on Mobile Human-Computer Interaction: Mobile Apart, Mobile Together*, 2021.



SEEN FROM ABROAD

News

FRANCE22

Title

FRANCE HOLDS THE PRESIDENCY OF THE COUNCIL OF THE EUROPEAN UNION

Within the framework of the French Presidency, Université Paris-Saclay will undertake various actions. Conferences, forums, as well as the Week of Innovative Regions in Europe (WIRE 2022) and the annual summit of the EUGLOH alliance will take place on campus from January to June 2022. This will help to promote French research and the important place of Université Paris-Saclay in this ecosystem.

https://www.enseignementsup-recherche.gouv.fr/fr/pfue-programme-de-l-enseignement-superieur-de-la-recherche-et-de-l-innovation-83243

Journal

Canaltech

Title

HEMISFÉRIO NORTE DE MARTE PODE TER ABRIGADO OCEANO HÁ 3 BILHÕES DE ANOS

O hemisfério norte de Marte pode ter abrigado um oceano de água líquida há de 3 bilhões de anos, segundo estudo conduzido pela Université Paris-Saclay.

https://canaltech.com.br/espaco/hemisferio-norte-de-marte-pode-ter-abrigado-oceano-ha-3-bilhoes-de-anos-206866/

Journal

BBC

Title

CLIMATE CHANGE: SATELLITES MAP HUGE METHANE PLUMES FROM OIL AND GAS

Huge plumes of the warming gas methane have been mapped globally for the first time from oil and gas fields using satellites.

Plugging these leaks would be an important step in buying extra time to curb climate change.

The new research found plumes covering vast areas, sometimes stretching to 200 miles – the leaks are thought to be mostly unintended.

https://www.bbc.com/news/science-environment-60203683

Journal

The Washington Post

Title

INTEL TO INVEST $36 BILLION IN NEW COMPUTER CHIP FACTORIES IN EUROPE

Effort is part of company's drive to fortify Western manufacturing of strategically vital components, and follows recent $20 billion investment in Ohio

https://www.washingtonpost.com/technology/2022/03/15/intel-europe-investment-manufacturing/

Journal

CONSULATE GENERAL OF FRANCE IN SAN FRANCISCO

Title

VISIT OF THE WINNERS OF THE PARIS-SACLAY UNIVERSITY STARTUP CHALLENGE

The winners of the Paris-Saclay University Startup Challenge were welcomed at the Consulate General of France in San Francisco on March 1, 2022 by the Deputy Consul General Olivier-Antoine Reynes, the Attaché for Science and Technology Jean-Baptiste Bordes and the Head of Industry and Technology at Business France Florence Tison.

https://sanfrancisco.consulfrance.org/visit-of-the-winners-of-the-paris-saclay-university-startup-challenge

Journal

The New York Times

Title

NEANDERTHALS AND MODERN HUMANS AGREED ABOUT ONE THING: THIS CAVE

A new paper suggests Neanderthals and Homo sapiens alternately settled the same shelter more than 50,000 years ago.

https://www.nytimes.com/2022/02/09/science/neanderthals-cave-france.html

Keywords
Moulon University Sports Centre – Inauguration of IJCLab

Title

New sports centres for the Saclay plateau

A number of new shared sports facilities dedicated to the student and research communities of Université Paris-Saclay, staff and local residents are flourishing on the University's various campuses.

Sport is an important part of Université Paris-Saclay, of its component institutions and associate member universities, as a vehicle for personal development, meetings and exchanges, and for a dynamic and stimulating living environment. In recent years, several new facilities have been built. After the "Lieu de vie" (Place of living) at Le Moulon in Gif-sur-Yvette in 2016 and the Joliot-Curie Sports Complex, integrated into CentraleSupélec, in 2017, the Moulon University Sports Centre (COUM), in the west of the district, is about to open its doors with its first courses. Outside, it will include four synthetic football and rugby pitches, an athletics track and jumping and throwing facilities. Inside, there will be dance and body-building rooms, a climbing structure, four tennis courts, a gymnastics hall with apparatus, and three multi-sports halls, one of which will have a 600-seat grandstand. "*It will be one of the most beautiful university sports complexes in France,*" says Patrick Maupu, director of the University Physical and Sports Activities Service (SUAPS). Subsequently, an aquatic centre, expected in the summer of 2024, will be built in the immediate vicinity of the COUM. It will include two 25-metre pools, a learning and activity pool with an access ramp for people with reduced mobility, and a fitness and well-being area.

Work on a new multi-sports centre in the future Corbeville district of Palaiseau also began at the start of the year. The sports complex will house two multi-sports halls with bleachers, a dance hall, a bouldering hall, three indoor tennis courts and a football/rugby ground. It is expected to open in September 2024.

This environment has earned the town of Gif-sur-Yvette, the Paris-Saclay agglomeration community and Université Paris-Saclay the 'Terre de Jeux 2024' label and the designation of four preparation centres for the 2024 Olympic and Paralympic Games. For example, the COUM will host delegations for handball and boccia, a paralympic bowling sport.

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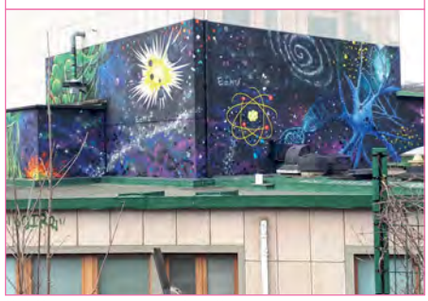
Title

Inauguration of the IJCLab



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Created on 1 January 2020, the Irène-Joliot Curie Physics of Two Infinities Laboratory (IJCLab – Univ. Paris-Saclay, Univ. de Paris, CNRS) is getting ready to celebrate its inauguration which will take place on 16 and 17 May 2022. The institutional inauguration in the presence of the supervisory bodies will take place on the afternoon of 16 May and the following day will be devoted to the laboratory staff.

This laboratory has around 720 members of staff and brings together five former laboratories on the Orsay campus which were geographically close and very compatible in terms of subject matter and technology (Centre for Nuclear and Material Sciences CSNSM, Imaging and Modelling in Neurobiology and Oncology IMNC, The Orsay Institute of Nuclear Physics IPNO, Linear Accelerator Laboratory LAL and the Laboratory of Theorectical Physics LPT).

The IJCLab focuses on the 'physics of the two infinities' (particle physics, nuclear physics, astrophysics and cosmology) and its applications (energy and the environment, as well as health), with areas of excellence in theoretical physics, R&D and accelerator construction. It also offers a wide range of research facilities and technology platforms (ALTO, Andromède, LaseriX, SCALP and Supratech, etc.).

https://www.ijclab.in2p3.fr/

WE WERE THERE

MARCH

Date	Location	Host
1 to 31	all campuses	Université Paris-Saclay

Title

EQUALITY WEEK 2022

Description

Around the International Women's Rights Day on 8 March, the University organised for the 7th consecutive year the Equality Week. Exhibitions, conferences, debates and workshops were offered on all the University's campuses.

https://www.universite-paris-saclay.fr/actualites/semaine-de-legalite-2022-lart-se-joue-des-genres-0

Date	Location	Host
15	Gif-sur-Yvette	Université Paris-Saclay

Title

MY THESIS IN 180 SECONDS FINAL

Description

Thirteen PhD students had three minutes to present their thesis during this MT180 final. Congratulations to Isabelle Hoxha and Olivier Destrian, respectively 1st and 2nd prize of the jury.

https://www.universite-paris-saclay.fr/actualites/ma-these-en-180-secondes-mt-180-les-gagnants-de-ledition-2022

APRIL

Date	Location	Host
20	Gif-sur-Yvette	Univ. Paris-Saclay / ENS Paris-Saclay

Title

PEDAGOGICAL INITIATIVES DAY (JIP) 2022

Description

Which pedagogical practices and which professional postures should be used in a changing world? This 7th edition, intended for the teaching and educational community of all disciplines, novice or confirmed, has contributed to enhance and disseminate teaching practices, and constituted a friendly space for exchanges and inter-institutional reflections on teaching practices.

https://www.universite-paris-saclay.fr/evenements/journee-initiatives-pedagogiques-jip-2022

DON'T MISS

MAY

Date	Location	Host
11 au 13	Gif-sur-Yvette	Ministry of Economy, Finance and Recovery / Université Paris-Saclay / Directorate General for Research and Innovation

Title

WIRE 2022

Description

As part of the French presidency of the European Union, the Week of Innovative Regions of Europe (WIRE) will take place at Université Paris-Saclay. This event will allow numerous exchanges on the issues of disruptive innovations.

https://www.universite-paris-saclay.fr/evenements/wire-2022-12th-edition-week-innovative-regions-europe

Date	Location	Host
18	Gif-sur-Yvette	Centrale-Supélec

Title

CARADOC 2022

Description

Doctoral students and young researchers from Université Paris-Saclay are invited to come and meet companies! On the programme: keynotes, stands and round tables with speakers from R&D industry, consulting, valorisation, administration, entrepreneurship...

https://bit.ly/36KcTdt

JUNE

Date	Location	Host
2	Gif-sur-Yvette	GS MRES

Title

MULTIDISCIPLINARY JUNIOR CONGRESS

Description

The Graduate School Research and Higher Education Professions (MRES) is organising the first edition of the multidisciplinary Junior Congress, which will introduce everyone to the research activities of students from all over Université Paris-Saclay!

https://www.universite-paris-saclay.fr/gs-mres-congres-junior

Date	Location	Host
until 11	CENTQUATRE Paris	CEA

Title

SCIENCE YOURSELF!

Description

From 12 February to 11 June, the French Atomic Energy Commission (CEA) is organising a series of meetings bringing together scientists, philosophers and video artists. The aim is to exchange views on the subjects of science and society.

https://www.cea.fr/Pages/actualites/institutionnel/science-toi-meme.aspx

Date	Location	Host
until 28	Orsay	Orsay University Library

Title

THE LOUVRE MOVES TO THE BU D'ORSAY!

Description

Until June 28, the Orsay university library is hosting the Louvre's Small Travelling Gallery, with the exhibition 'Figure d'artistes' (Artist Figures). This exhibition focuses on the figure of the artist, its emergence and recognition through time, thanks to reproductions of works from the Louvre and a scenography provided by the museum.

https://www.universite-paris-saclay.fr/actualites/le-louvre-sinstalle-la-bu-orsay

JULY

Date	Location	Host
3 au 8	St Lambert des Bois	SPS

Title

SPS SUMMER SCHOOL – PLANT SUGAR METABOLISM, TRANSPORT AND SIGNALING IN A CHALLENGING ENVIRONMENT

Description

The Saclay Plant Sciences (SPS) network is organising a summer school called Sugars in Plants to provide young international scientists with excellent training on the subject.

https://www6.inrae.fr/saclay-plant-sciences/Evenements/Ecoles-d-ete/Ecole-d-ete-2022-Sucres

université PARIS-SACLAY

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READING HIGHLIGHTS

THE CONVERSATION

IPCC report: halving greenhouse gas emissions by 2030 is possible

Céline Guivarch, Director of Research at the International Centre for Research on Environment and Development (CIRED – Univ. Paris-Saclay, AgroParisTech, CNRS, École des Ponts ParisTech, CIRAD, EHESS) and Senior Lecturer at École des Ponts ParisTech, and Franck Lecocq, Director of Cired and Professor of Economics at AgroParisTech, present the third part of the sixth IPCC report on mitigating global warming.

https://theconversation.com/rapport-du-giec-diviser-les-emissions-de-gaz-a-effet-de-serre-par-deux-dici-a-2030-cest-possible-180513 (in French)

How the melting of the Greenland ice cap could displace malaria in Africa

Alizée Chemison, a PhD student at the Laboratory of Climate and Environmental Sciences (LSCE – Univ. Paris-Saclay, CNRS, CEA, UVSQ), is studying the impact of climate change on infectious vector-borne diseases. At the heart of her work is the possibility that malaria will be forced to move because of global warming.

https://theconversation.com/comment-la-fonte-de-la-calotte-glaciaire-groenlandaise-pourrait-deplacer-le-paludisme-en-afrique-180167 (in French)

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Thank you and enjoy reading!

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address ..... city .....

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postal code ..... country .....

email .....

INTERDISCIPLINARY INITIATIVES AT UNIVERSITÉ PARIS-SACLAY (1/3)

AllCan

Allcan is seeking to develop an 'Alliance for the Climate: Act now!' in order to unite the University's teaching and research units around the technological challenges posed by climate and ecological transitions by setting up courses, an innovation centre and research combining university and technological knowledge.

GS involved: Biosphera; Economics & Management; Engineering and Systems Sciences; Geosciences, Climate, Environment, Planets; Humanities – Heritage Science; Sociology and Political Science.

H-CODE

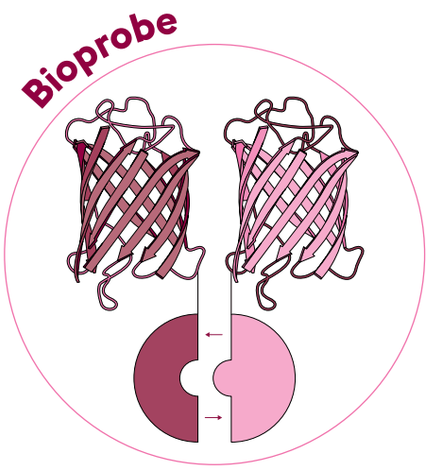
Human-in-the-Loop for Control and Decision is aimed at the theoretical study of decision making at the individual, group and societal levels using mathematical modelling methods.

GS involved: Computer Science; Economics & Management; Engineering and Systems Sciences; Life Sciences and Health; Mathematics; Sport, Movement, Human Factors.

IES

The Institute of Sustainable Energy focuses on sustainable ways of producing, storing, converting, distributing and using energy, taking into account related economic and societal aspects.

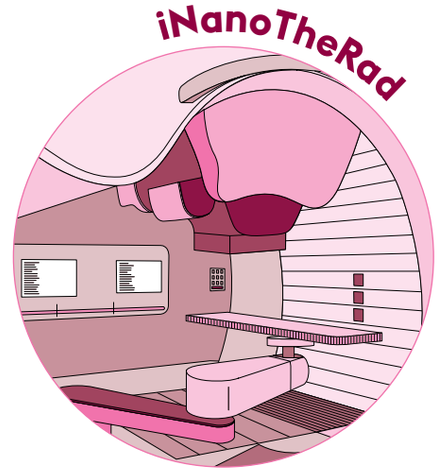
GS involved: Chemistry, Economics & Management; Engineering and Systems Sciences; Humanities – Heritage Science; Institute for the Sciences of Light; Physics.



The aim of BioProbe is to promote innovative projects in Chemistry and Physics for the study of biological processes in complex environments and cell signalling for diagnostic and imaging applications.

GS involved: Biosphera; Chemistry; Health and Drug Sciences; Life Sciences and Health; Physics.

The aim of Interdisciplinary Initiatives is to be able to carry out research, training and innovation activities across several of the University's Graduate Schools (GS).



iNanoTheRad aims to offer new clinical solutions based on the use of innovative radiation sources, drugs and nanoparticles to increase the sterilization effect on tumours, to combat radiation resistance and to personalise treatment by integrating artificial intelligence solutions into the treatment process.

GS involved: Chemistry; Engineering and Systems Sciences; Health and Drug Sciences; Institute for the Sciences of Light; Life Sciences and Health; Physics.

C-BASC

The Centre for Interdisciplinary Studies on Biodiversity, Agroecology, Society and Climate aims to contribute to the study, design and implementation of ecological and agroecological transitions through interdisciplinary research, training and innovation.

GS involved: Biosphera; Economics & Management; Geosciences, Climate, Environment, Planets; Humanities – Heritage Science; Life Sciences and Health; Sociology and Political Science.

HEALTHI

The Institute for Health Research and Therapeutic Innovation aims to better understand the pathophysiological mechanisms of diseases, to improve prevention (biomarkers, imaging) and the treatment of diseases (drugs, medical devices, etc.) in order to better educate and treat patients (therapeutic education, patient management, societal acceptance of treatments).

GS involved: Chemistry; Health and Drug Sciences; Life Sciences and Health; Public Health

LM@W

LivingMachines@Work aims to understand the fundamental molecular mechanisms of life in order to innovate in the fields of health and biotechnology. LM@W focuses on biological machines, their structure, functioning, integration into cellular networks, evolution and applications in biotechnology.

GS involved: Biosphera; Computer Science; Life Sciences and Health; Mathematics; Physics.