SPRING 2020

GIANT REVIEW

— Exploring Science in Grenoble —

3D Printing: Expertise helps revolutionize manufacturing

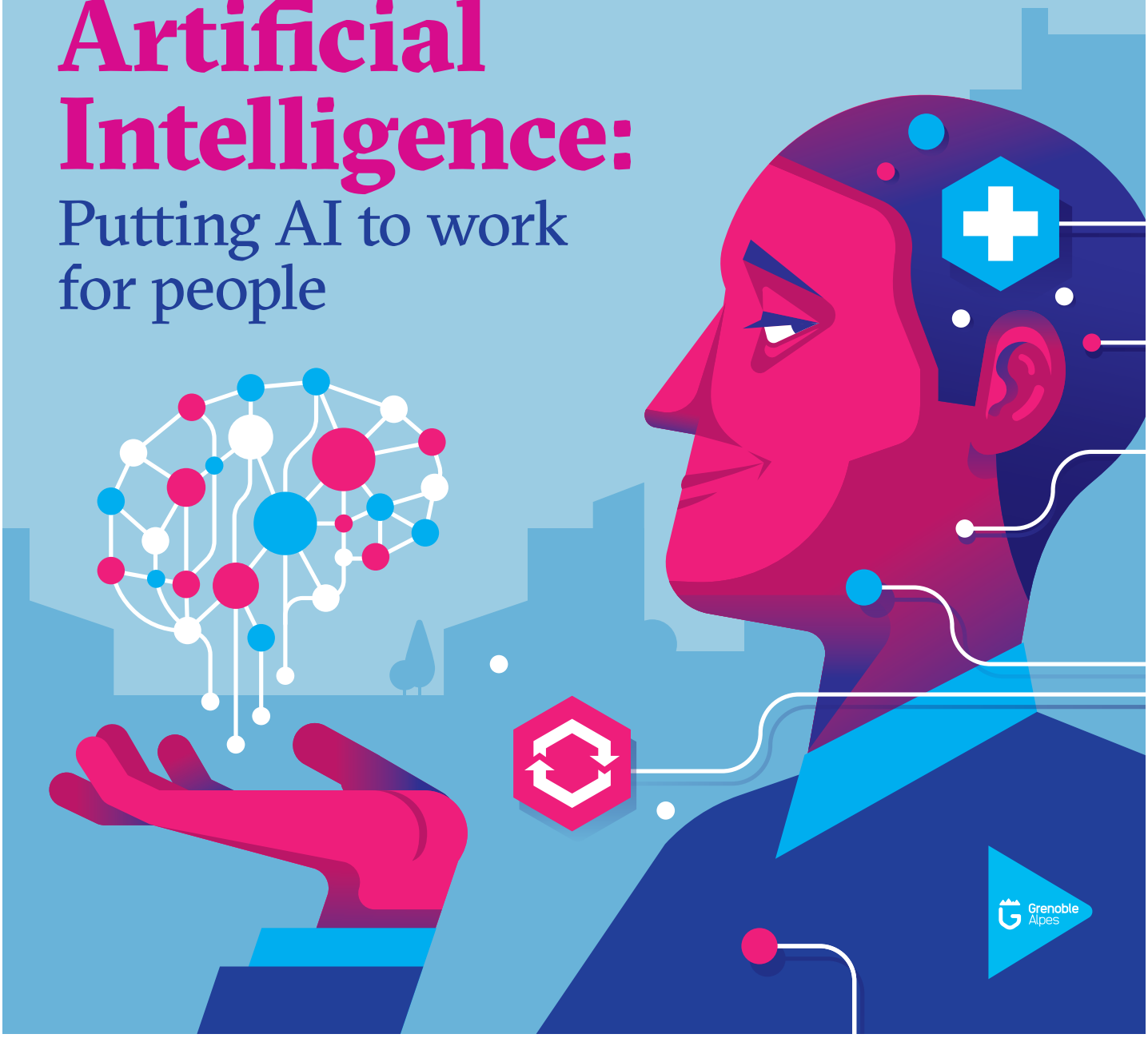
Internet: The lighter side of the Darknet

Health: A study of antimalarial drugs breaks new ground

Energy: Could wearable electronic devices be powered by sweat?

Artificial Intelligence:

Putting AI to work for people



GIANT (Grenoble Innovation for Advanced New Technologies) unites research, higher education and industry on a unique campus to overcome the major challenges of tomorrow.

Founding members: CEA, CNRS, EMBL, ESRF, GEM, ILL, Grenoble INP and UGA.

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Innovation Management

Applied research and new business creation as well as innovation and industrial performance training for managers.

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AWARDS & HONORS

Marie-Aude Méasson (CNRS, Institut Néel)
ERC Consolidator Grants 2019

Guillaume Balarac (Grenoble INP – Ense3 and LEGI)
Hope Prize from the Institut Mines Telecom (Academy of Sciences)

Emmanuel Billy (CEA-Liten)
Prize for Academic Innovation at the Innovation Recycling Trophy

Michel Campillo (UGA)
Elected to the Academy of Sciences

Benoit Cerutti (CNRS, OSUG)
ERC Consolidator Grants 2019

Benjamin Sacépé (CNRS, Institut Néel)
ERC Consolidator Grants 2019

Grenoble Ecole de Management (GEM)
Positive Impact Rating for Business Schools: Students reward Grenoble Ecole de Management's positive environmental impact

Centre National de Recherche Scientifique (CNRS) • Commissariat à l'énergie atomique et aux énergies alternatives (CEA) • European Synchrotron Radiation Facility (ESRF) • Grenoble Ecole de Management (GEM) • Grenoble Institut National Polytechnique (Grenoble INP) • Institut Laue-Langevin (ILL) • Université Grenoble Alpes (UGA)

Welcome to the spring 2020 GIANT Review

In its current state, AI takes on two forms: machine learning and computer vision. While you might not notice it, it's all around. Machine learning and computer vision are used in science, government, business, and in consumer technology. We've seen great progress in the last decade—and we'll see even more in the coming years, as AI technology evolves and as it is applied to more domains.

The ecosystem formed by GIANT partners covers the range of skills needed to help take AI into the future. That's why, last year, the French government chose Grenoble as one of the places to establish the Multidisciplinary Institute in Artificial Intelligence (MIAI), with three areas of focus: research, education, and application.

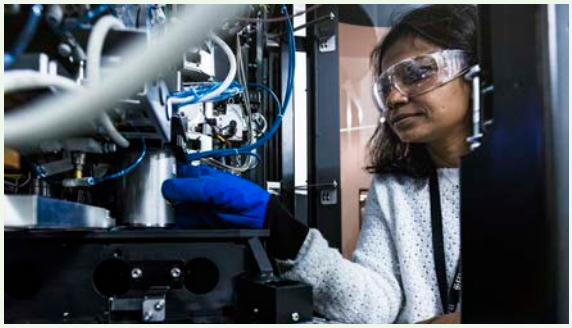
GIANT partners are conducting research that will help build the solutions of the future: CNRS is developing AI algorithms that will help medical professionals make the right movements during surgery; and CEA is bringing AI to small devices, through embedded platforms that draw inferences from data and make intelligent decisions, using very little energy in the process.

Two other GIANT partners, ESRF and ILL, are making advances in the use of AI to automate experiments—and soon, they will also be using machine learning to help spot patterns in data collected from powerful photon and neutron sources in Grenoble. Then there are the schools: GEM, Grenoble INP, and UGA. These GIANT partners are building the degree programs and the executive education offerings that will give us the know-how to design AI solutions and apply those solutions to specific industries.

As for EMBL, we have built up a cluster of high performance computers in Heidelberg and are using it to train deep neural networks to recognize sequence patterns that underlie cancer mutations. That's just one example of how we are using AI to help further the understanding of biological systems. As you will read in this publication, EMBL has also used machine learning to rank phosphosites by importance, so scientists can focus their efforts on protein phosphorylation where it matters most for the human organism.

On behalf of all GIANT members, it is my pleasure to share with you this most recent issue, which highlights some of the latest developments from the GIANT campus, with a special focus on artificial intelligence.

Stephen Cusack
Head of European Molecular Biology Laboratory, Grenoble



AN ESRF COVID-19 RESEARCH PROJECT FUNDED BY ANR

An ESRF COVID-19-related research project is among the 86 projects selected by the ANR, the French project-based funding agency for research, to fight the coronavirus pandemic. This project targets the non-structural polyprotein 3 (Nsp3) of SARS-CoV2 as an important therapeutic target. High-end molecular biology, biochemical and structural methods will be combined with sophisticated cryo-EM approaches, thereby integrating complementary trends in modern molecular biology. This project is based on the use of the CryoEM platform, operated by the ESRF in collaboration with its partners of the EPN Science campus – EMBL, IBS and ILL.

I-PHD awards GRAND PRIZE FOR INNOVATION IN FIGHTING THE FLU

Emeline Richard Millot, of CERMAV (CNRS) won the grand prize for the Glycoflu project, which aims to market a new generation of drugs the fight the influenza virus. The prize was awarded on February 6, 2020 at the i-PhD innovation competition, held in Paris to support young researchers and entrepreneurs.

Currently incubated by SATT Linksium, Glycoflu is developing a new approach to combatting the influenza virus. The startup expects to mass-produce glycanes, a type of sugar that attracts all variants of the influenza virus, luring them into a trap. By latching onto the virus, the molecules prevent it from reaching respiratory cells and further infecting the host.

The awards ceremony was a big success for GIANT partners: 7 UGA doctoral and post-doctoral candidates also came back to Grenoble with prizes.

Getting the word out on HOW DIGITAL TECHNOLOGY IMPACTS PEOPLE, ORGANIZATIONS, AND SOCIETY

A new Chair was created at GEM, called Digital Organization & Society—DOS for short. The mission of the DOS Chair is to communicate the results of studies on how digital technology impacts people, organizations, and society to a wider audience.

Coordinated by Pierre Dal Zotto, Assistant Professor in Information Systems, and Fanny Rabouille, Director of the Masters Program in Big Data, the Chair will benefit from an expert team of 15 researchers and professors at GEM. The DOS Chair will run a series of conferences, called "CDOS Thursdays", targeting students, professionals, and enterprise partners.

EMBL ALUMNI meet for the docking of the Tara expedition, and forge new collaborations

The Tara expedition was scheduled to stop in Marseille in September 2019, so EMBL Grenoble decided to organize an alumni event around the stopover. The event brought together EMBL alumni from all around France, and beyond—alumni who are now working in a variety of areas.

Attendees listened to talks on a range of subjects—and, in some cases, found new opportunities for future scientific collaboration. "Even if our scientific subjects are very diverse, there are links between different fields," says Juan Reguera, EMBL alumnus and Group Leader at AFMB Inserm, Marseille.

At the request of Stephen Cusack, Head of EMBL Grenoble, Reguera helped organize the event together with a second EMBL Grenoble alumnus, Renaud Vincentelli, Head of the AFMB facility for high-throughput cloning, expression, purification and interaction of proteins.

PROTECTING PRICELESS WORKS OF ART with neutrons

Centuries-old works of art can be damaged when solvents are used to remove varnish on paintings during the restoration process – the 20th century is said to have the largest number of damaged paintings because of deliberate restoration.

New research uses neutrons to examine how solvents penetrate the varnish of a painting – studying the precise varnishing used for most restoration efforts since the 1960s

The study findings can help to inform and prevent the destruction of precious artwork during restoration and lead to the creation of standards for the reliable automation of art restoration in future.

➔ www.ill.eu/news-press-events/news/scientific-news/protecting-priceless-works-of-art-with-neutrons/

BEFORE AFTER

PAPERTOUCH PREPARES ITS INNOVATIVE E-PAPER FOR MARKET

PaperTouch, a startup incubated at SATT Linksium, plans to industrialize an environmentally friendly e-paper, paper with electronic circuits printed into the bulk during the manufacturing process. Made primarily of cellulosic fibers, and without glue, PaperTouch products will be easier to recycle than other e-papers.

Fanny Tricot will lead PaperTouch to market. A graduate of Grenoble INP-Pagora (a graduate school of engineering in paper, print media, and biomaterials), Tricot started work on the underlying concepts during her post-doctorate work under the MINT Chair, which is sponsored by Schneider Electric and two laboratories that are part of Grenoble INP: LGP2 (CNRS, Grenoble INP) and IMEP-LAHC (CNRS, Grenoble INP, UGA, Université Savoie Mont-Blanc).

Currently incubated at SATT Linksium, the startup will target a number of applications, including interactive books, interactive wallpaper, and breath-sensitive pads that can be used by people with tetraplegia.

A GIANT LEAP TOWARDS PRINTABLE FUEL CELLS

Researchers at CEA-Liten broke new ground: Using printed components and continuous process technologies, they produced a 1kW proton exchange membrane fuel cell (PEMFC) stack. The proof-of-concept demonstrated techniques that boost power densities, while at the same time reducing costs.

PEMFCs convert the hydrogen and oxygen in the air into electricity and heat. Channels in the cells' bipolar plates carry the gases to the area where the reaction takes place. Conventional stamped-metal bipolar plates have nearly reached their limits, because the pattern sizes are about as small as they can get.

With Liten-patented printing techniques, it is now possible to reduce pattern sizes, opening up the opportunity to reach as high as 6 kW/L.

A new understanding of GLOBAL FORCES contributing to Antarctic melting

Researchers from UGA, CNRS, Sorbonne University, and from Portugal and the United Kingdom recently reported new details on the causes of surface melting in West Antarctica. The team found that atmospheric rivers transporting heat and moisture from the mid-latitudes and sub-tropics are a major contributor—and their study reveals how these rivers are formed and pushed southward.

While other studies have concentrated on local processes that contribute to the melting of snow and ice, this one is the first to focus on large-scale meteorological phenomena. This new research demonstrated that when anticyclones block extra-tropical cyclones from moving from west to east, their natural paths, atmospheric rivers are forced south, carrying the heat and humidity to the Antarctic.

The results and analysis of the study were published in Nature Geoscience on October 28, 2019.

A study of **ANTIMALARIAL DRUGS** *breaks new ground*

Without knowing exactly how the most widely used antimalarial drugs work, researchers have had to resort to guess work to develop variations that target new strains of the parasite.

#European Large Scale Facilities — #Health

ESRF scientist Peter CLoetens at ID16A beamline.

In the last two decades, the plasmodium parasite—the parasite responsible for malaria—has evolved into drug-resistant strains, increasing the geographic spread of the disease. This puts more than 40% of the people in the world at risk.

Concerned governments, NGOs, and scientists are all eager to develop a new generation of antimalarial drugs, but nobody has ever been able to study them in vivo to characterize how they work at a molecular level. *"Not knowing how the drugs work makes improving their design a matter of guess work,"* says Yang Yang, who at the time was Beamline Scientist at ESRF.

When the plasmodium parasite ingests hemoglobin, it liberates heme as a byproduct. This heme would normally be toxic to the parasite. But the heme crystallizes into hemozoin, which renders the molecules harmless. As long the rate of hemozoin crystallization is faster than the parasite liberates the heme molecules, the parasite survives.

While scientists have long known that Quinoline-family drugs destroy the parasite, nobody knew how. One important theory has been that these antimalarial drugs work by interfering with the process of crystallization of heme in the malaria parasite. Previous studies designed to prove or disprove this theory produced ambiguous results and very little new data. That's because these experiments were performed on either model systems or on dried parasites outside their natural environments.

A more recent study, in which real parasites were observed in their near-native environment, changed the playing field.

Lead by Sergey Kapishnikov of the Niels Bohr Institute, a team of scientists broke new ground by using special sampling techniques and cutting-edge equipment: They used soft X-ray cryo-tomography to map molecular structures in 3D at BESSY-II and ALBA, and hard X-ray fluorescence nano-probe to map bromine and iron distribution on ID16A at ESRF.

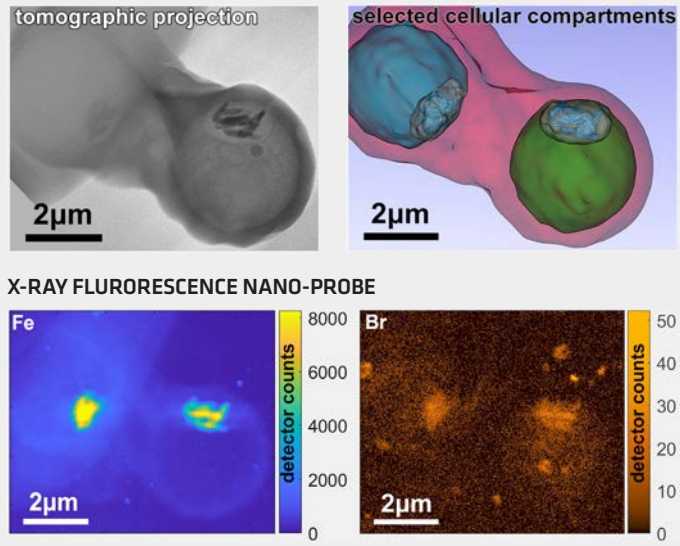
The research team studied in vivo the mode of action of a bromo analog of the drug chloroquine in rapidly frozen red blood cells that had been infected with plasmodium falciparum. *"Using nondestructive X-ray microscopy, we were able to observe that bromoquine caps hemozoin crystals,"* says Yang. *"We could also measure which facet of the crystal surface was covered, and deduced that this coverage was sufficient to block further growth of hemozoin crystal—and therefore block the process of heme detoxification."*

"We also saw that bromoquine accumulates in the parasite's digestive vacuole, reaching very high levels, which further enhances the drug's efficacy by preventing the remaining heme from docking

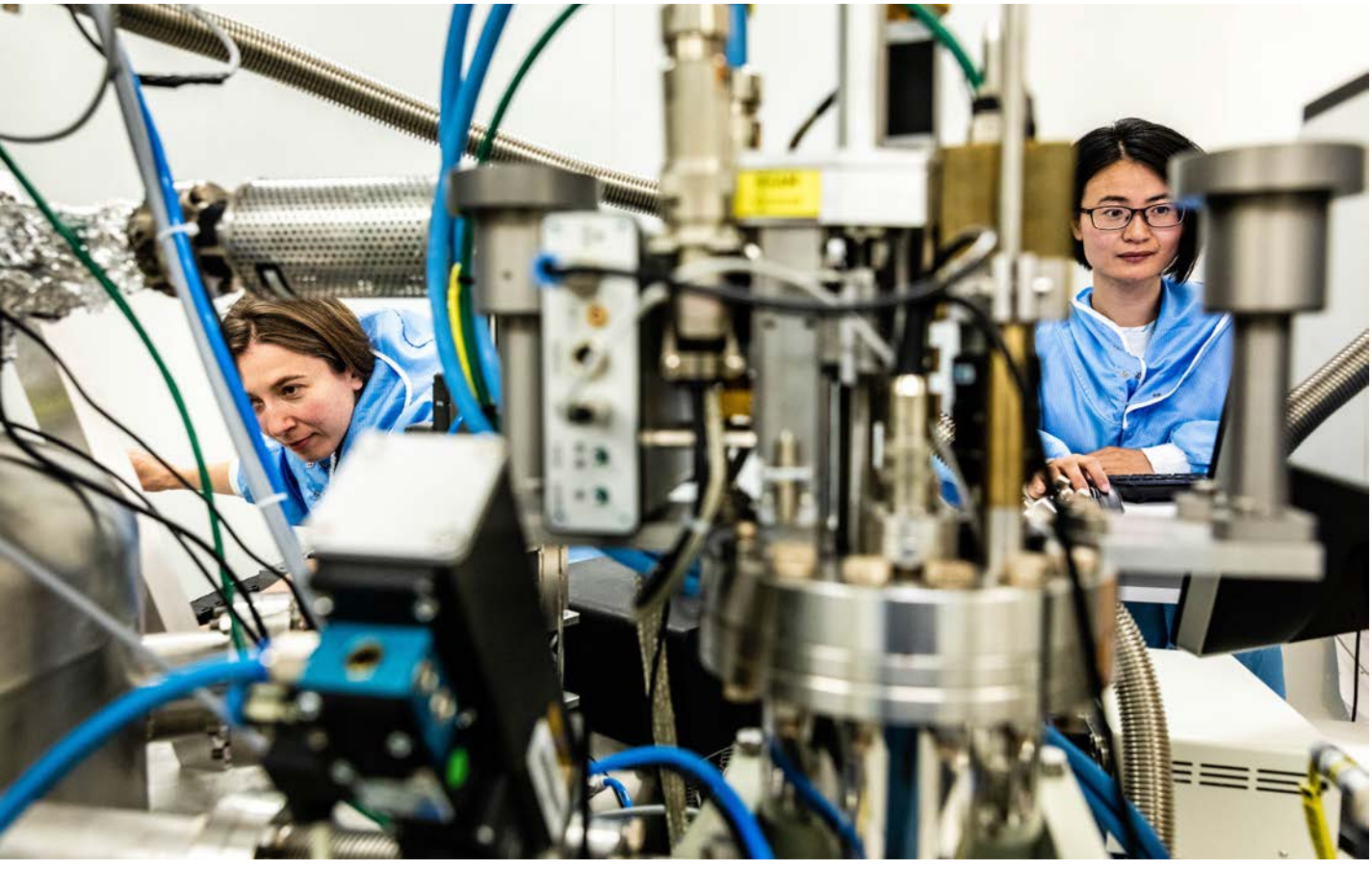
onto the hemozoin crystal surface. The excess bromoquine forms a complex with the heme. This complex is driven outwards to the digestive vacuole membrane, which it often punctures, causing the heme to spill into the interior of the parasite."

The innovative process of rapid freezing used in this study creates snapshots, capturing chemical distribution within a cell at a given stage of a biological process. Once frozen, the samples have to be maintained under cryogenic conditions at all times. Using this technique combined with nondestructive X-ray microscopy, scientists can study molecular structures in near-native conditions.

For this reason, this study is significant not only in its findings, but in its novel approach which can be extended to studies of other families of antimalarial drugs.



The same infected blood cell (with parasites in blue and green in the top right picture) in correlatively mapped by two methods: SXT at BESSY-II and X-ray fluorescence nano-probe at ESRF



Yang Yang (right), one of the author, during the experiment at ESRF ID16A beamline.

The lighter side of **THE DARKNET**

Very few people write and speak out about the positive social impact of the Darknet. Here's one.

#Innovation — #Information Technology

JEAN-PHILIPPE RENNARD
Professor at Grenoble École de Management (GEM)

"The Darknet is the subject of a vast campaign of misinformation," says Jean-Philippe Rennard. *"If you take a closer look, you'll see that it exists for a reason—and it can do a lot of good."*

As we all know, whenever we browse the Web, or do just about anything on the Internet, we can be traced very easily. The information exchanged on the Internet is rarely anonymous.

> ***"But sometimes you have legitimate reasons to hide your identity," says Rennard. "And that's where the Darknet comes in."***

"The Darknet" refers to the collection of darknets—subspaces in the Internet, in which people can exchange information and remain anonymous. Darknets hide the identities and locations of users through specific protocols, several layers of strong encryption, and a technique called *"tunneling."* Tunneling is same technique used by virtual private networks (VPNs) to make a device appear to be on a different network—and maybe even in a different country.

The idea of remaining anonymous on the Internet is not at all new. Some of the original architects of Internet developed protocols to keep servers hidden from other users. Later on, in the early 2000s, the US government developed some of their own techniques and protocols to make sure government operatives remained untraceable on the Internet. Many of these same tools have laid the foundation for the today's darknets.

Nowadays, darknets facilitate black markets—anything from illegal file sharing (for example, to download videos or music without paying for them) to insider information on the outcome of sports events (for example, to increase your chances of winning a bet). Darknets also facilitate anonymity—hiding the identities of anybody from drug-dealers to whistleblowers, people who want to provide information to journalists without being discovered.

Rennard is quick to point out the difference between anonymity and confidentiality: *"Anonymity is when we don't know who you are. Confidentiality is when we know who you are, but we don't know the contents of your exchanges."*

"Anonymity is often associated with some of the more reprehensible acts that take place on darknets," says Rennard. *"Take the famous example of Silk Road, which was a black market within the darknet TOR. People sold illicit products on Silk Road—hard drugs, for example. Silk Road closed in 2013, and was replaced by a lot of other markets that do the same thing."*

"But anonymity also provides freedom of expression for people in countries that don't allow people to speak out. Dissidents can leak information to journalists and remain anonymous.

> ***Darknets allow access to social networks, web sites, or television channels that are forbidden in some places. It's the only way some people can access Facebook or BBC."***

"Let's take another example," says Rennard. *"In some countries, homosexuality is illegal, even punishable by death. The Darknet may be the only channel of communication for homosexuals in those countries. It allows people to connect, and communicate without the risk of being discovered."*

Rennard has always been interested in the social impact of new technologies, an interest that naturally led him to the Darknet—so much so that he authored *"Darknet, Mythes et réalités"*, a book which is now in its second edition. He has also given TED talks on the subject.

The Darknet is really just another tool, he says. Like any other tool, when put in the wrong hands, it can be used for malign purposes. But in the right hands, it can be put to good use—like helping people fight oppression, and the growing tendency towards social control.

Jean-Philippe Rennard's book about the myths and truths of the Darknet

Could wearable electronic devices **BE POWERED BY SWEAT?**

Led by CNRS researcher Serge Cosnier, the Biosystèmes Electrochimiques et Analytiques (BEA) team at the Département de Chimie Moléculaire UMR CNRS 5250 of the Université Grenoble Alpes and CNRS demonstrated a stretchable and wearable enzymatic biofuel cell (BFC) that harvests energy from sweat.

#Fundamental Research — #Energy

One of the major application areas for wearable electronic devices is healthcare. Wearables can monitor motion, sense physico-chemical signals, or help heal wounds. But despite tremendous progress in the component technology, energy remains the biggest obstacle preventing the use of these devices on a wide scale. So far, most of these devices have been constrained by batteries, which are cumbersome and require user intervention for recharging. To make matters worse, batteries are hazardous to the environment.

To open up opportunities for practical use of wearable electronic devices, many researchers have been looking for ways of using the human body to provide the power. One promising approach is based on BFCs that are worn on the skin and use lactate from human sweat as a substrate. Given the limited concentrations of lactate in sweat, the first challenge to this approach is finding the material that will provide the necessary energy density.

The answer may be buckypaper (BP), a new material with a range of interesting properties, including strength and conductivity. Made by aggregating carbon nanotubes, which are approximately 50,000 times thinner than a human hair, a single sheet of BP looks like old-fashioned typewriter carbon paper. Several sheets can be arranged in different ways to enhance specific properties, such as strength or electroconductivity. Until now, two challenges have prevented the practical use of BPs as a basis for epidermal BFCs: energy density and flexibility.

The BEA group recently overcame both these challenges. First they cross-linked carbon nanotubes with polynorbornene linear polymers and then they modified carbon nanotubes with redox molecules and enzymes. The resulting enzyme-buckypaper matrix provides the required power density and exhibits flexibility and mechanical resistance.

In collaboration with prof Joseph Wang from University California San Diego, the group combined this new class of BPs with a stretchable polymeric support based on a stretchable ink formula with an island-bridge architecture. The electrodes were separated into hard non-stretchable *"islands"*, which are firmly bonded to the substrate. Soft and stretchable serpentine-shaped *"bridges"* connect the islands, so that when external strain is applied, the stress is distributed to the stretchable bridges.

"We demonstrated that biofuel cells can be used as a high-performance carbon electrode material for epidermal biofuel cells with a stretchable supporting substrate," said Cosnier.

> ***"This self-sustaining power source could very well usher in a new generation of wearable electronics."***

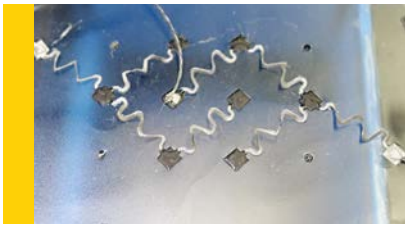
Practical applications would have a printed patch attached to the human epidermis in one of many possible locations where perspiration is usually present—for example, the arm, neck, chest, or back. The patch would be activated when, after a few minutes of exercise, perspiration begins. The lactate would be absorbed into the hydrogel electrolyte and permeate to the electrodes.

Because this kind of BFC relies on perspiration, applications would be limited to those where the user is exerting enough effort to sweat. Another potential complication is that the amount of power generated by a BFC depends on the concentration of lactate, which varies from one individual to another, and from one activity to another. *"Fortunately,"* says Cosnier, "the median values of lactate for human sweat, 14 mmole/L, exceeds the value required to obtain the maximum BFC power.

In the near future, research will focus on improving the catalytic anode performance of each individual bioelectrode, and on better integrating the electronics for extensive on-body operations.

GIANT EFFECT

This demonstration of a biofuel cell that harvests energy from sweat was the result of ongoing collaboration between UGA and CNRS researchers.



Demonstrator of the stretchable and wearable enzymatic biofuel cell (BFC).

Expertise in **3D printing** helps **REVOLUTIONIZE MANUFACTURING**

Before manufacturers can start mass production of just about any part, they need to do research on the processes and materials they plan to use—and ideally run a few tests until they get it right.

#Fundamental Research — #Industry

THIBAUD FLEURY

In charge of Industrial Partnerships within the Département des Technologies des Nouveaux Matériaux (DTNM) of CEA Liten, Thibaud Fleury's job is to connect DTNM laboratories with industrial partners—small and medium businesses, as well as large companies.

"In Grenoble we focus specifically on identifying the best pairing of materials and manufacturing process for our partners' specific applications," says Fleury. "This identification of optimal pairings is key:

For a given material there is a set of processes that could be used—and vice versa, for a given process, certain materials could be used.

We consult with our partners to help them match processes and materials for their specific applications."

The team works with a large variety of materials—including polymers, metals, composites, ceramics, and magnetic materials. The processes they work with are *"near net shape"* processes—processes that are close to the final shape of the component, and therefore use as little material as possible, generating smaller amounts of waste. Additive manufacturing, also known as 3D printing, is a near net shape processes, and includes a wide range of technologies and techniques.

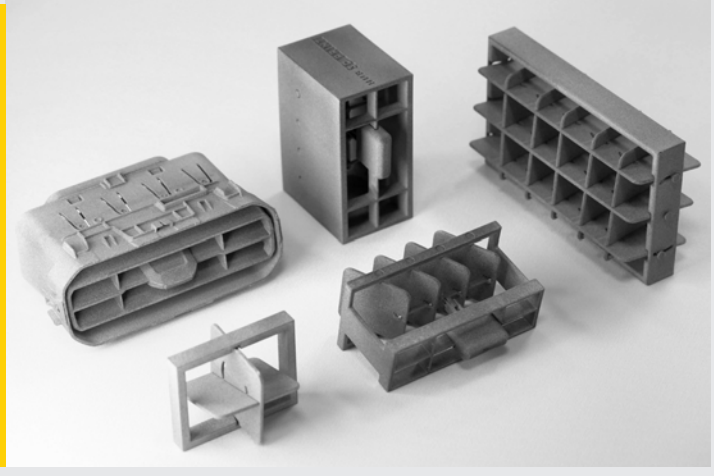
"We try to identify the best 3D printing technologies that match with end user needs,"

says Fleury. *"One of the things we do to help advise our partners is benchmark how certain equipment and processes perform with certain materials."*

In addition to benchmarking, Fleury's team helps partners with different steps in the manufacturing process, starting with the choice of materials and the characterization of those materials. As for the design phase, the team helps partners make design decisions to minimize waste, reduce the weight and volume of parts, reduce assemblies, and sometimes even to add extra functions to the parts that come out – functions like thermal dissipation or instrumentalization. The team also advises partners on post processing procedures—finishing techniques that render the part functional and more efficient. The final step is advanced characterization to validate what was produced—an important step in which Fleury's team plays a role to help verify everything worked as planned.

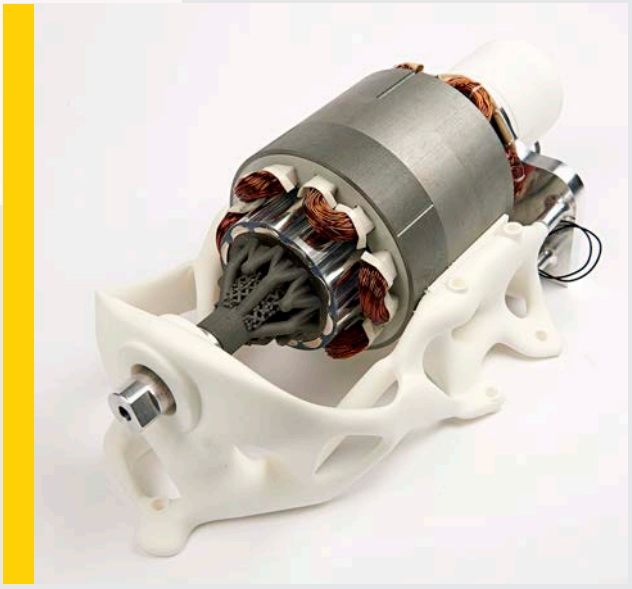
For the characterization of input materials and of the final parts, the DTNM group of CEA Liten relies on help from two other GIANT institutes—ESRF and IL—who help not only with equipment, but also with expertise in material science.

Additive manufacturing overcomes some of the inherent inefficiencies in subtractive manufacturing. Not only does subtractive manufacturing involve cutting away from a block of material to produce a part, but it is also limited



Polymer additive manufacturing: 3D printing of an aerator basic functions

Metal additive manufacturing: Copper inductor produced in 3D metal printing



3D motor: Motor whose rotor and supporting structure have been produced in 3D printing, in Iron Silicon alloy

in terms of design. *"Sometimes we help partners apply additive manufacturing to make a combination of parts in one run,"* says Fleury.

CEA Liten has formed partnerships with a number of OEMs (original equipment manufacturers). The current partnerships are with AddUp and HP—two equipment providers CEA works with to support the development and testing of additive manufacturing processes in the pre-industrialization phase. AddUp provides industrial 3D printing solutions for metal; HP specializes in 3D printing solutions using polymers.

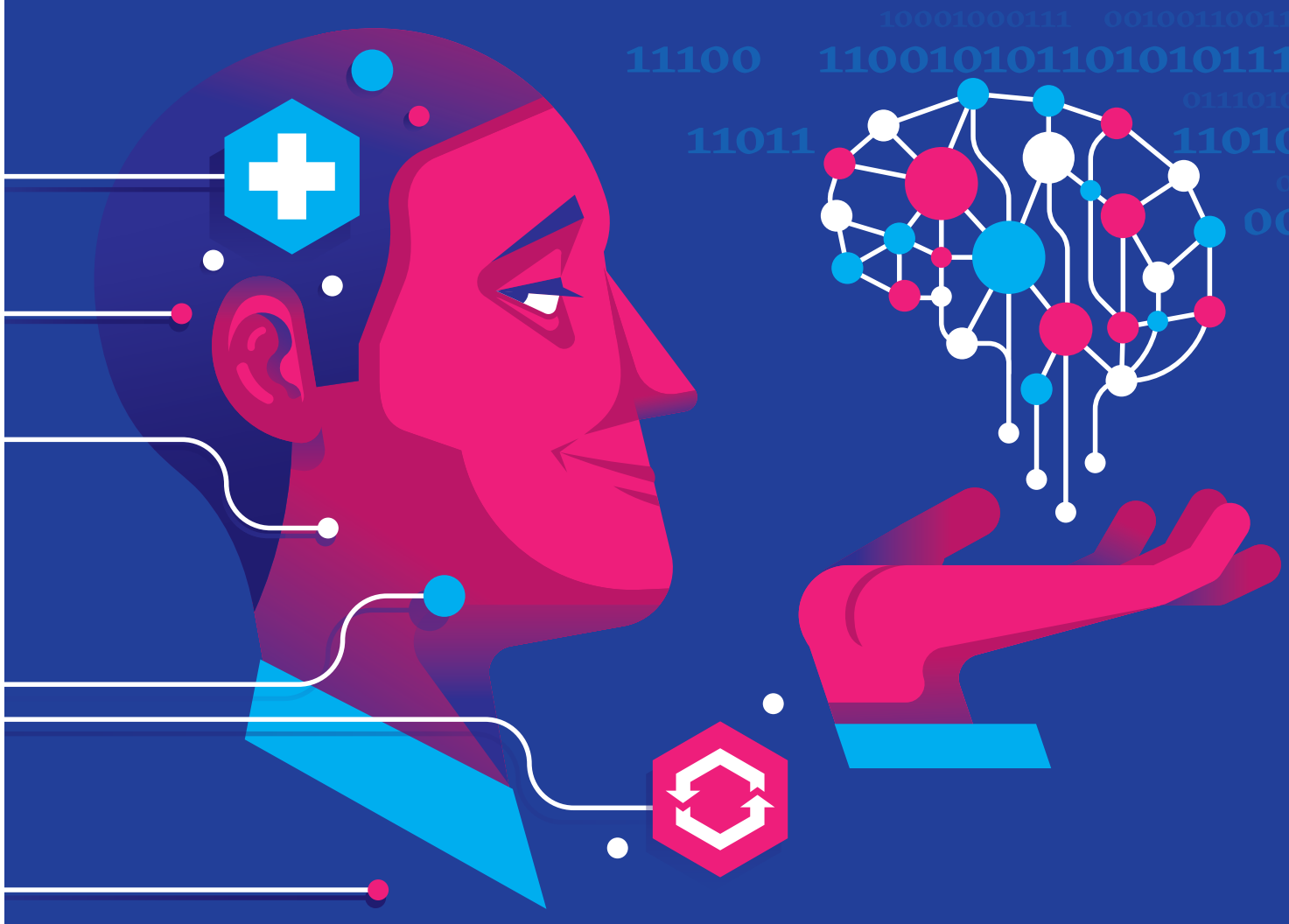
CEA Liten and AddUp set up Famergie, a hub that serves as a test bed for projects that use 3D printing, based on Laser Beam Melting (LBM), to produce metal parts for the energy sector. Famergie stands for *"fabrication additive métallique pour l'énergie"*, which translates to *"metal additive manufacturing for energy."*

Similarly, for manufacturing based on polymers, CEA Liten and HP established a multi-sector ecosystem with collaborative R&D programs that help in the development and testing of projects based on HP's Multi Jet Fusion 3D Printing solution.

"The value of our work with OEMs like AddUp and HP is that we allow manufacturers to explore new concepts and validate their applications before going into mass production," says Fleury.

GIANT EFFECT

To provide the best services possible, CEA Liten benefits from the equipment and expertise in material science at ESRF and ILL.



Artificial Intelligence:

Putting AI to work for people

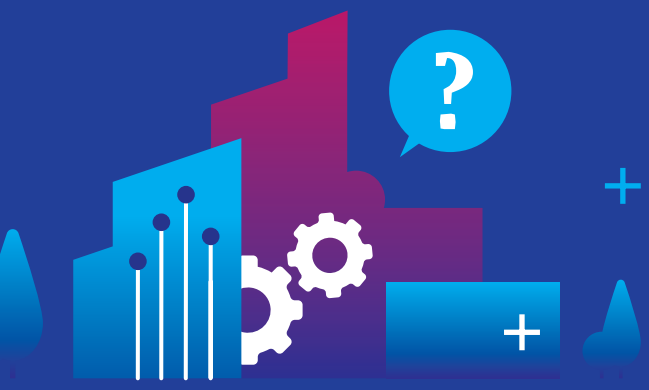
Science has become more data intensive than ever. Any piece of equipment that measures matter on a very small scale generates an enormous number of bits and bytes. While this data contains patterns that help researchers draw inferences, it also contains noise that needs to be filtered to get to what's important. That's why some GIANT researchers have started using computer vision and machine learning to sift through data.

But that's not all that's happening with AI on the GIANT Campus. Researchers are also using AI to make experiments quicker and more reliable—for example, they use machine learning to identify optimal equipment settings in a fraction of the time it takes a

person to do so, and without the human error. And after experiments are run, and data collected, GIANT researchers are beginning to use AI to catalog information, so that scientists at other institutes around the world can find what they need without having to run their own experiments.

Let's not forget about the industrial use of AI. Researchers on the GIANT Campus are creating platforms that provide AI functions to a number of application areas. And the educational institutes on the GIANT campus are setting up new programs to make sure industrial players have the skills they need to put AI to work in their domains. One such domain is healthcare, where computer vision and machine learning are already in great demand—some GIANT researchers are devising algorithms that might one day make surgical procedures more consistent.

But perhaps most importantly, GIANT researchers are asking the right questions about ethics. How we address these questions will determine how well we put AI to work for people.



MIAI Grenoble Alpes is off to a good start

The Multidisciplinary Institute in Artificial Intelligence (MIAI) Grenoble Alpes was established in 2019 to develop AI along three big dimensions: research, education, and application in companies. The French government selected Grenoble as a center for the institute, and is providing financial support. Local universities and enterprises are also contributing funds.

The Director of MIAI is Eric Gaussier, Professor of Computer Science at Université Grenoble Alpes (UGA). "*Grenoble has the right ecosystem for this kind of institute,*" says Gaussier. "*We have a number of organizations conducting leading-edge research in AI. We also have leading business and engineering schools, major industrial players, and a rich community of startups It's no accident that the French government chose Grenoble for this project.*"

Research will be around two main themes. The first is future AI systems. This includes machine learning and reasoning, perception and interaction, and hardware architectures that support AI. The second theme is AI for human beings and the environment. Here research will be about how AI affects society and the environment—and the use of artificial intelligent in healthcare, energy, and Industry 4.0.

That's not all. MIAI will also help create new degree programs in artificial intelligence—both for full time studies and for work-study programs. The goal is to double the number of graduates with skills in AI within 5 years.

As for the application of artificial intelligence, MIAI is counting on support from the business community—and it's off to a good start. So far, 55 companies have committed to help fund MIAI. This includes 23 large companies, 21 SMEs, and 11 startups.

"*We plan to help shape the next phase of AI,*" says Gaussier. "*Of course, technology and techniques are a big part of it. But it's mostly about human beings—making AI more understandable and putting it to work to improve human society.*"

Using AI to help guide surgical movements

MIAI has set up four separate Research Chairs for Healthcare. One of them is the "Computer Assisted Medical Intervention (CAMI) Assistant" Chair, which is co-directed by Jocelyne Troccaz and Sandrine Voros. The two co-directors work together at the TIMC-IMAG laboratory, a joint research unit shared by four institutes: CNRS, UGA, Vetagro Sup, and Grenoble INP.

One area of focus for the CAMI Assistant Chair is to develop AI algorithms that help surgeons and other medical professionals perform the right actions. *"We can analyze recorded video-assisted surgical procedures and use the information to model the 'right' procedure: which instrument is used, where and when – and how the actions are sequenced,"* says Troccaz. *"We can find out which variations of a procedure are authorized, and which are undesirable."*

"Our goal is to develop systems that build models from videos and then use these models, possibly in real time, to help medical professionals during surgery," says Troccaz. *"This technology is not only a matter of image processing—it's also about modeling complex medical interventions."*

Applying AI to healthcare is nothing new for the researchers at TIMC. They have been developing these kinds of systems for around 3 decades, and some have been used in hospitals for several years. The algorithms they develop have to take into account the context of the intervention—and they often have to be patient-specific. They acquire data on patients from different sources and fuse that data to build a model, which is then used to make decisions.

In some cases, a human operator remotely controls a CAMI assistant. In other cases, the systems are more autonomous—for example, a robot uses control algorithms to synchronize its position to a target that moves in an unpredictable manner. This involves capturing data in real time, using models to draw inferences from the data, and then making decisions that steer the robot.

Jocelyne Troccaz hints about exciting things on the horizon: *"We are currently very interested in robots that can go inside the human body and have some autonomy of movement and action to accomplish a task."*

GIANT partners boost education in artificial intelligence

Director at Grenoble INP-Ensimag, Jean-Louis Roch is co-head of the Educational Board of MIAI, along with Massih-Reza Amini of Université Grenoble Alpes (UGA). The first objective of the Education Board is to train more professionals in techniques and application of artificial intelligence—to more than double the annual output of graduates skilled in AI.

"We've estimated that by the end of 2018, around 700 graduates had been trained in AI in one form or another, and we aim to put out 1500 graduates in 2022," says Roch. *"In addition to the university programs we're developing, we're also developing executive training to help stimulate business use."*

The MIAI Educational Board is working with Grenoble INP and UGA to create two labels: *"AI Practices and Application"*, which focuses on applying artificial intelligence to different industries, and *"AI Core and Integration"*, which is about the design, analysis and implementation of machine learning and decision technology.

"In the label 'AI Practices and Application', the students are specialists in a specific domain—for example, social sciences, healthcare, logistics, or energy," says Roch. *"They need AI to carry out their work, to innovate in their respective fields. You might think of students who study under this label as users of AI."*

"You can think of students who study under the 'AI Core and Integration' label as experts in the design of AI systems. This label is about integrating AI in computer systems, including embedded systems as well as large applications. We also cover Edge computing, making decision at the edge of the network, close to the use rather than deep inside the cloud. Small devices will need to request AI services from the network. When the services are close to the requesting device—that is, at the edge—the response time is reduced."

It helps that Grenoble is already bursting with expertise in computer technology, everything from chip manufacturing and embedded systems all the way up to high-level applications tailored for a specific field. Roch says that industrial players in the region have already developed a number of very specific applications based on artificial intelligence. One example is an application that improves production by predicting anomalies, for instance for car furniture or paint. Another is an application that improves energy usage in cities—a "Smart City" application. Other cases include AI systems that help diagnose rare diseases, and systems that help with surgical control.

Off to a good start towards doubling the annual output of graduates with skills in AI, the MIAI Education Board expects to certify 800 to 900 new graduates in 2020.

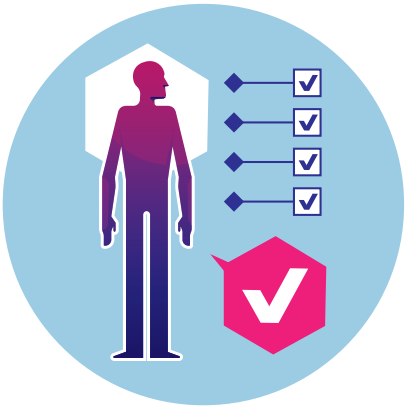
Machine learning points scientists to the phosphosites worth studying

Protein phosphorylation is a type of protein modification that may activate or deactivate a protein—or change it in a number of other ways, including its localization within the cell, and its function. Mutations in positions of a small number of these modifications can lead to disease. Scientists would like to focus their attention on these modifications, if only they could identify the ones that are important.

"We looked in the PRIDE [PRoteomics IDEntifications] database, here at EBI, that contains a huge amount of publicly-available mass spectrometry data, and we processed it to get a very state-of-the-art definition of which positions on human proteins get modified by phosphorylation," says Pedro Beltrao, Group Leader at the EMBL's European Bioinformatics Institute (EMBL-EBI). The result was the world's largest reference phosphproteome, a catalogue of almost 120,000 human phosphosites, which are protein sites associated with phosphorylation.

But that was just the beginning. The research team then set out to develop a tool that could identify the phosphosites that are critical for human cells, and that could play a crucial role in human disease. This is where machine learning came in.

Scanning the existing scientific literature, the team found around 2,000 phosphosites that were known to be important for human cells. Using other sets of available data, such as data on phosphosites in other species, the team found around 60 features that correlated with the relative criticality of a phosphosite.



The researchers developed a machine learning algorithm and used the 2,000 phosphosites to train the algorithm to rank phosphosites by importance based on the 60 features. After training the algorithm, the researchers then demonstrated the efficacy of their new AI tool by having it identify two high-scoring phosphosites that play a role in regulating neuronal differentiation.

"I want to stress how important it is that scientists share data," says Beltrao. *"To give you an idea of how much work it takes to produce the data we used, it would require around 500 days of continuous experimental time from one machine to generate the mass spectrometry data that we used. We are very grateful for being able to re-use so much effort from the mass spectrometry community—a level of sharing that doesn't exist in all fields of science."*

In this spirit, the EMBL-EBI team made their phosphproteome and AI-based scoring system available to the scientific community to help researchers around the world understand which proteins are phosphorylated and which phosphosites have functional relevance.

Energy efficient embedded AI, inspired by the human brain

Machine learning involves two major processes: training and inference. An AI algorithm must first learn through large data sets. Only then can it be put to work, taking in new data and drawing inferences or making predictions based on what it knows from the training phase.

Using cloud computing for the training part makes sense, because the training data is usually on the cloud already, and the cloud has all the processing power needed for the compute-intensive training phase. But when it comes to inference, it's usually best to put the processing as close as possible to the user, because that's where the data is.

"It's for these reasons that a lot of people are working on systems where training occurs in the cloud, but then inference occurs on a system embedded in a chip," says Frederic Heitzmann, who is in charge of embedded AI at the CEA. *"These chips are then used in small devices like phones, watches, or sensors."*

While some such systems are already sold on the market, researchers at CEA have come up with a novel approach: They developed a circuit that mimics certain mechanisms of the human brain in a way that enables a system to recognize very simple images, using very little energy.

The first aspect of this approach that was inspired by the brain is that the circuits use Spiking Neural Networks. Spiking Neural Networks differ from traditional neural networks in that, like the brain, they encode the pieces of information into discrete events (spikes), rather than into bits and bytes as most computers do.

AI IS THE HEROINE OF CEA-LETI'S FIRST WEB SERIES!

If you're a fan of web series and eagerly looking forward to new releases...Let your curiosity prevail and treat yourself to CEA-Leti's first web series broadcast on the Institute's YouTube channel! In this 2-season, 13-episode series, two CEA research engineers (including Frederic Heitzmann) invite you to discover on-board artificial intelligence: edge AI.

A second aspect of the human brain the researchers mimicked was to collocate memory and processing. Until very recently, virtually all computer designs placed memory and processing in different locations, connected by a bus or a network. But because transferring data over a bus or networks uses precious energy and takes time, the CEA team opted for something different. They used a new family of memory chips, Resistive RAM (RRAM), which has storage and processing located on the same circuit.

Machine learning revolutionizes the study of matter through photon and neutron sources

Scientists have already started using AI to help study matter on a nanometric scale in two different ways. The first is measurement optimization, which involves automating the different tasks that make up an experiment. The second use of AI is to find patterns in data—an AI system can spot patterns scientist would never find.

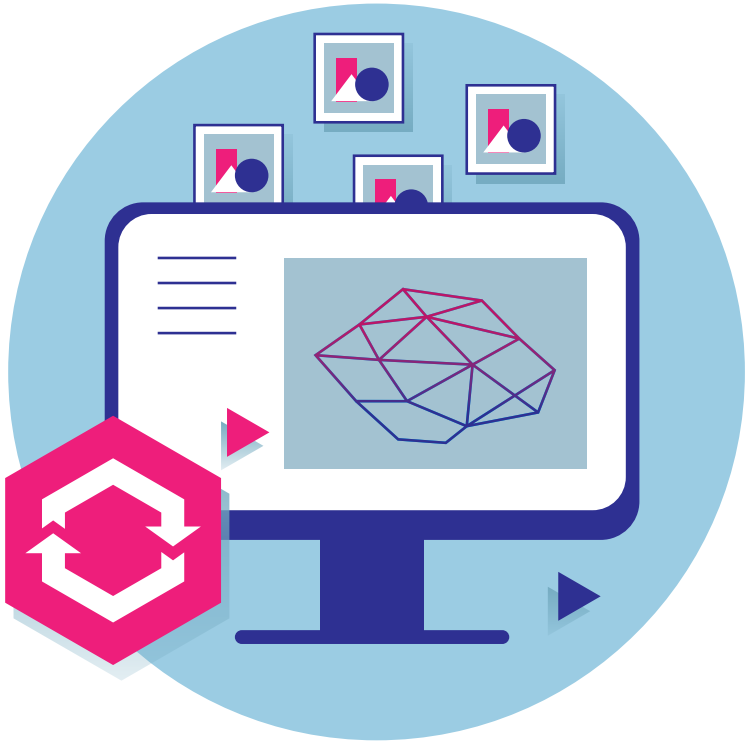
So far, ILL has developed two new methods that use AI for measurement optimization. Both are prototypes that are undergoing final phases of testing before being put to use in production.

The first method applies to small angle scattering, which relies on a complex instrument with a lot of parameters to set. The process of tuning the instrument is a critical precursor to running an experiment. But the speed and quality of tuning is highly dependent on the person doing it, which means that outcomes are inconsistent.

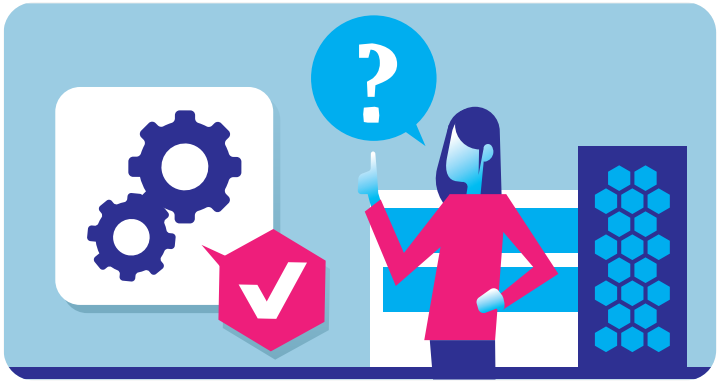
"We now have a prototype of a new method, which suggests instrumental setups, based on analysis of the first image, without needing to any particular knowledge of the parameters of the experiment," says Paolo Mutti, Head of the Scientific Computing Division at ILL.

The second project uses computer vision to figure out the 3D volume of a complex crystal with only one rotation and in real time. *"Remember that when we talk about crystals, we're not talking about diamonds, which are perfect,"* says Mutti. *"A crystal can have any crazy shape. To find the volume scientists have to make a movie of the crystal turning it around. Then they go through the movie, picture by picture, selecting each edge manually and then calculating the volume of that part of the crystal as a function of the rotation angle. In the end, they add up the local volumes to get the volume of the whole crystal. Our method uses AI to perform the calculations in real time, a big improvement over the current process."*

"We expect these two new methods to save both time and money," says Mutti. "The final goal is to optimize the precious beam time to maximize the number of experiments performed."



How AI affects us in the long run depends on the ethical discussions we have now



According to Ismael Al Amoudi, while AI creates new opportunities, it also creates a number of threats. Now is the time to begin ethical discussions around these opportunities and threats, knowing that the decisions we make today will impact us for years to come.

Full professor at Grenoble École de Management (GEM), and co-author of the book *"Post-Human Institutions and Organizations: Confronting the Matrix"*, Al Amoudi says that as soon as enterprises start using AI to help make decisions, it becomes very difficult to have a moral discussion about the principles underlying the decision-making processes. AI functions like a black box: You know the input and you know that output, but you no longer have control over the process that gets you from input to output. This means you can no longer have a normative discussion about how and why an enterprise made one decision versus another.

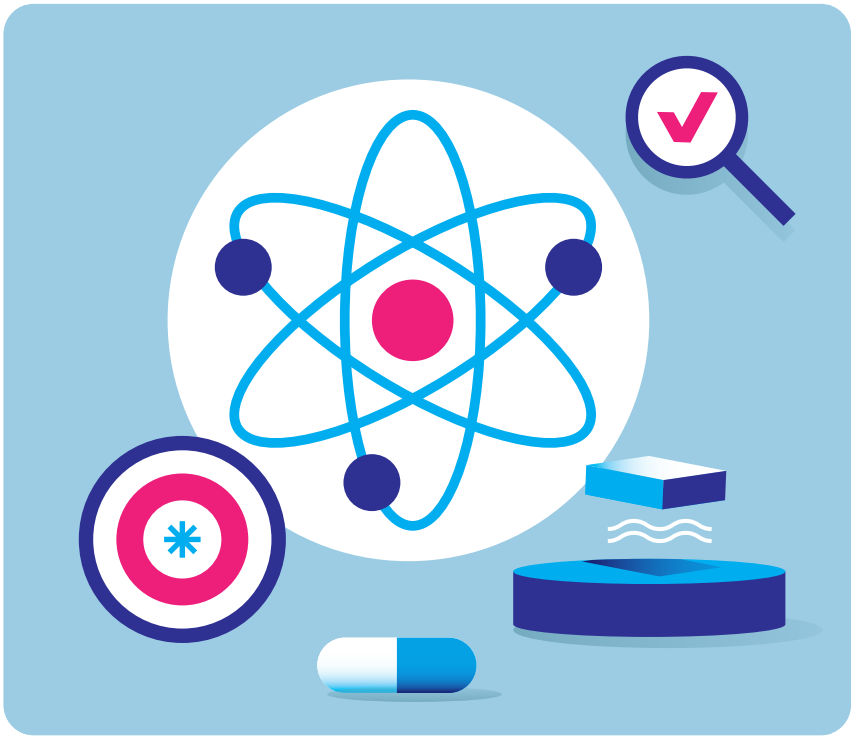
Take for example, the use of AI in the healthcare sector to make decisions about which segment of a population gets reimbursed for a given treatment or medication. A society might decide that hip replacement is elective surgery, except for cases where not replacing the hip poses some other health risk to the patient. Each case is different enough to warrant a discussion. If you leave to artificial intelligence to decide you completely lose control of how the decision is made. Until now, enterprises could justify such decisions by referring to norms, and the general public could approve or disapprove of the normative basis.

Al Amoudi says that the big winners in AI are clearly enterprises. The trouble is, people who are shareholders in an enterprise also play other roles in society. They are clients. They are citizens. They may be workers and they may also be parents. The use of AI to help their stocks go up may be harmful to their interests as clients, citizens, workers, and parents.

"The risk is that users who win in the near term, may lose in the long term," says Al Amoudi. "How this plays out will depend on the discussion we have today."

GRENOBLE ECOLE DE MANAGEMENT DIGITAL, ORGANIZATIONS AND SOCIETY CHAIR

The Digital Organizations and Society Chair was developed to create and share scientific knowledge about the impacts of digital technologies on individuals, organizations, and society. The chair relies on fifteen GEM professors and researchers exploring the effects of digital technologies in our daily lives: the way we work, they way we connect, the way businesses innovate to create value, the degree to which organizations embrace digital technology, and their capacity to adapt to a new way of working.



The first international workshop on using AI to help study matter on a nanometric scale

November 12, 2019 was the first day of the first international workshop on artificial intelligence, machine learning, and neural networks applied specifically to the use of photons and neutrons to study the smallest bits of matter. The three-day event, jointly organized by STFC, ILL, and ESRF, was held in the ESRF auditorium, and attended by 160 people onsite, and another 2,500 via the ESRF YouTube channel. The workshop featured specialists from around the world, delivering presentations on how artificial intelligence may soon revolutionize the study of matter on a nanometric scale.

"One can imagine a lot of different applications," said Rudolf Dimper, Head of the ESRF Technical Infrastructure Division (TID). *"But the most prominent application is to de-noise data and perform pattern recognition to spot artifacts. With machine learning you can extract from the data very faint phenomena, which would otherwise remain undetected."*

Machine learning relies on algorithms that must first be trained with large amounts of data—the more, the better. Before closing the lab for reconstruction of the accelerator in 2018, experiments at the ESRF had already produced 9 petabytes of data, much of which could potentially be used for machine learning algorithms.

"If you extend the data we already have, and include the data sets from other laboratories, things become pretty exciting," said Dimper. *"But the data from the other laboratories has to be in a similar format, of similar quality and properly curated. And this is the reason we have PaNOSC—the Proton and Neutron Open Science Cloud, which is sponsored by the European Union."*

ESRF and ILL have a big stake in PaNOSC, making sure photon and neutron data produced by big research institutes adheres to FAIR (Findable, Accessible, Interoperable, and Re-usable) principles. If the data is in good shape, it can be used to train the machine learning algorithms that will change the way matter is studied—and that is a worthwhile thing to do.

"If you understand how matter is organized, you can understand a little bit about how the world works," said Dimper. *"For example, you can find out the best way to administer antibiotics into the core of a cell in exactly the right quantities. Or you can study the underlying features of certain materials that may be used for superconductivity."*

Breakthrough speed in **3D NEUTRON TOMOGRAPHY** opens up a range of possibilities

New technology and innovative methods increase the temporal resolution of neutron tomography by nearly one order of magnitude.

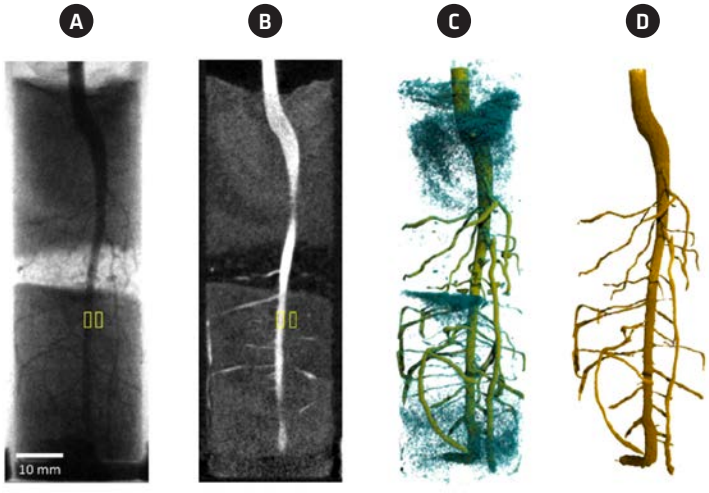
#European Large Scale Facilities — #Biology

Because neutrons are very sensitive to hydrogen, neutron tomography is widely used to study systems that involve hydrogen-rich fluids, such as water. Neutron tomography works by firing neutron beams onto an object to produce hundreds of projection images, which are then analyzed by computer systems to generate 3D representations. With the right equipment—and enough computing power—it's even possible to get 4D representations, with the 4th dimension being time. In this case, neutron tomography produces a series of 3D images, a sort of movie that allows researches to follow a process over time.

Researchers would like to use 3D and 4D representations, for example, to study the fluid flow inside complex structures, such as soils and other geomaterials. The problem is that, while neutron tomography is an ideal approach for studying heterogeneous media, image acquisition rates are usually too slow to follow fast-moving processes, such as fluid flows. For this reason, researchers have had to do their best with 2D neutron radiography to study a number of phenomena in situ, such as the water imbibition of soil aggregates, water transport in sandstones or rocks, drying of concrete and water transfer in root-soil systems. Fortunately this has all changed in the last year.

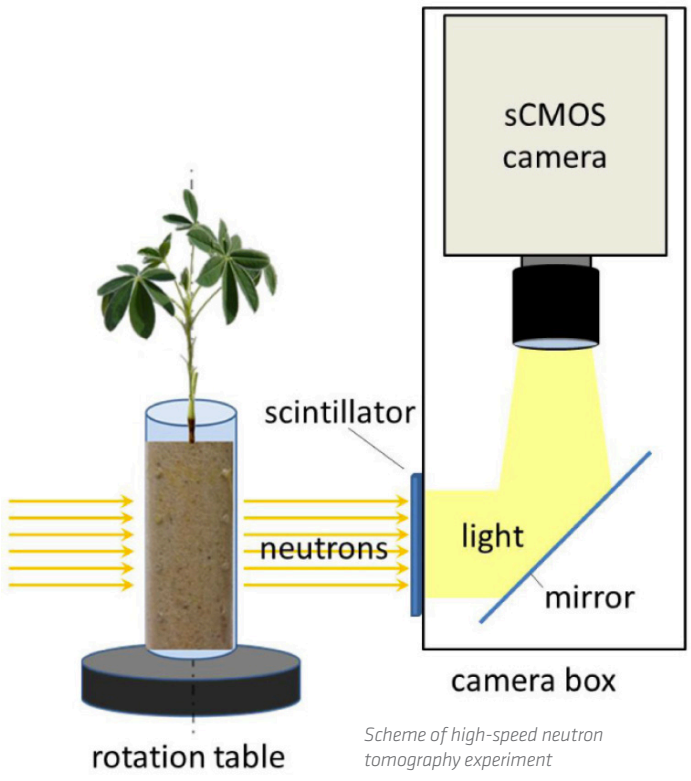
Scientists at ILL set a new record on the acquisition time for neutron tomography—and in doing so, they opened up possibilities to study fluid flows in 3D, or even 4D.

This breakthrough was achieved in a study of the effect plant roots have on fluid flows in soil. While it was already well known that plant roots do modify the hydraulic properties in the rhizosphere, the region of soil surrounding the root, a team of researchers led by Christian Tötzke of the University of Potsdam wanted to understand exactly how the flows are affected. So they turned to the Institut Laue-Langevin (ILL) for help.



High-speed neutron tomography of a lupine root system grown in sandy soil. Time resolution is 1.5 s per tomogram marking a new speed record for neutron tomography.

- *(A) Raw radiographic projection. Yellow rectangles indicate regions used for contrast calculation.*
- *(B) Vertical tomographic slice of the reconstructed sample volume. Yellow rectangles indicate regions used for contrast calculation.*
- *(C) 3D-rendered view of the sample. Roots are false-colored in green, qualitative soil water distribution in turquois.*
- *(D) 3D-rendered view of the segmented root system // Photo 3- Time series. of neutron tomograms showing the rise of water in a soil column with a living lupine root system after injection of deuterated water through the bottom.*



Scheme of high-speed neutron tomography experiment

With an optimized imaging setup on the high-flux instrument, a team led by ILL research scientist Alessandro Tengattini acquired full tomographies with 155 projection images, and a physically spatial resolution of 200 microns, for a duration of 1.5 seconds. That's 6.7 times faster than the previous record.

"The equipment we used was already in place," says Tengattini. *"We made some minor technical changes–for example, we had to adopt a new rotation stage to rotate the plants fast enough. The rest was a matter of calibration and optimization:*

> ***Through trial and error, we found a compromise between spatial resolution, temporal resolution, the signal to noise ratio, and the needs of the process in question."***

The experiment was performed by growing a plant in soil inside a glass cylinder. As the researchers injected water into the soil, the rotation stage rotated the cylinder. The projection images were acquired and used by a computer system to generate the 3D tomographic images. The researchers used these tomographic images to discover how the plant's roots changed the fluid flows in the soil.

According to Tengattini, this fast imaging setup is now in place at ILL in Grenoble, and will open up opportunities to in a number of applications: *"With this new speed, you can study fluid flows in plants, like we did. Or you can study things like the injection of water into rocks to find breaking points. In the US there are a lot of people who are interesting in breaking points for hydrofracturing, to extract gas from shale. But it's also important for more eco-friendly applications, such as breaking rock to extract geothermal energy from the ground."*

"We could have made the tomography a little faster in our experiment, but it was not required by the process. However, there are many other applications that require even more speed. If we can achieve another order of magnitude increase, even more will be possible: We could study things like the temporal behavior of batteries under impact."

Tengattini is rather optimistic about taking that next step: *"There is an upgrade of the instrument going on right now at ILL. We are hoping this will help us speed up neutron tomography by another order of magnitude, taking it down to 0.1. or 0.2 seconds."*

Extending the lifetime of batteries based on ZINC ANODES

A growing number of experts agree that zinc-based batteries would be better than lithium at meeting our future needs—and a handful of researchers are removing the remaining obstacles to make it happen.

#Energy

JULIEN THIEL
CEO of Easyl

One of the biggest problems human beings face in the twenty-first century is storing electricity. According to Julien Thiel, *"We are not yet good at it."*

Graduate from Grenoble INP, Thiel is now CEO of Easyl, a company that collaborates on research projects with Grenoble-INP, CNRS, and Laboratory of Electrochemistry and Physico Chemistry of Materials and Interfaces (LEPMI), which is located on the UGA campus. The research is centered on zinc batteries.

According to Thiel, zinc anodes have many advantages over lithium. One is that zinc is cheaper. It is more abundant in the earth's crust than lithium, and it can be extracted with processes that are less harmful to the environment. Another advantage is that zinc batteries are safer than Lithium Batteries.

"Lithium works well in portable computing devices, such as phones and laptops, because users accept the fact that they will have to change the battery every two years," says Thiel. *"That's around 700 cycles, since you discharge and recharge about once a day over the two year period."*

"But when it comes to batteries in houses, you have to come up with something that lasts around ten years," says Thiel. *"That's because people will never accept having to change a big battery like that every two years."*

House batteries will become very important in the future, because you need them to store renewable energy, which is inherently intermittent.

Solar panels can only generate energy when the sun is shining, so electric companies draw the energy from houses and businesses with solar panels and store it centrally. According to Thiel, in countries that have a lot of solar energy, the electrical networks are flooded. A better solution is to decentralize storage—to store the energy very close to where it most likely to be used.

Thiel thinks that in a few years, Easyl technology will make it possible to build zinc-based batteries that last for 5,000 cycles, using recyclable materials and production processes with reduced CO2 emissions. Furthermore, he thinks he can bring production costs down."

Easyl's goal is to revolutionize the battery industry, to provide a new and sustainable battery value chain in Europe and enhance its global competitiveness, in view of the decarbonization objectives

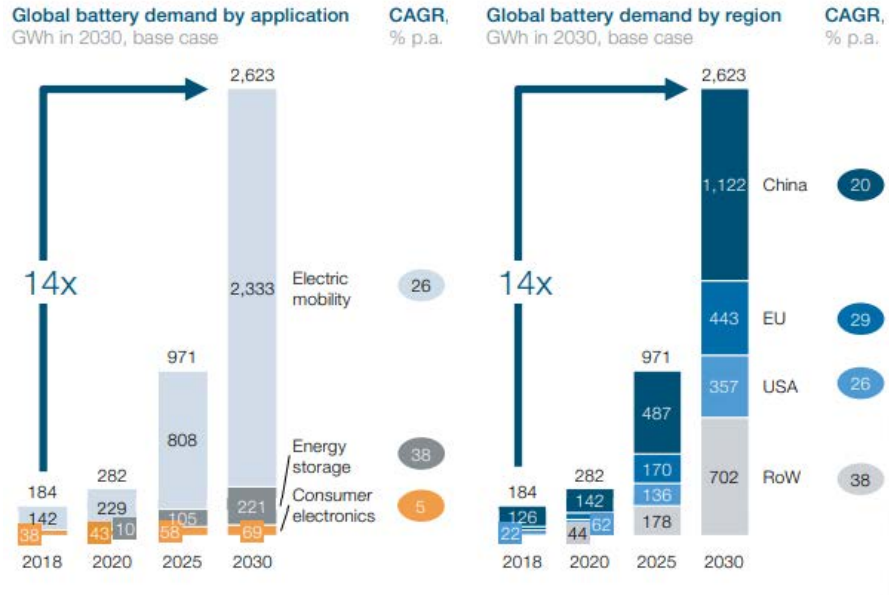
We focus entirely on zinc anodes," *says Thiel.* "We are interested in both zinc nickel and zinc air. One of our major achievements was to revolutionize the production of calcium zincate, a key element of any zinc anode. We have done this by developing an ultra-fast process of synthesis, based on ready-to-use ink to manufacture the electrodes."

"Now our goal is to understand electrochemical behavior during charge and discharge cycling. This understanding will help us extend the lifetime of batteries based on zinc anodes."

The kind of work Easyl is doing will go a long way towards meeting the growing demand for battery power. According to the report *"A Vision for a Sustainable Battery Value Chain in 2030: Unlocking the Full Potential to Power Sustainable Development and Climate Change Mitigation"*, written by the Global Battery Alliance and published by World Economic Forum in September 2019, the global demand will reach 2600 GWh by 2030. That represents a compounded annual growth rate of 25% from 2020 to 2030.

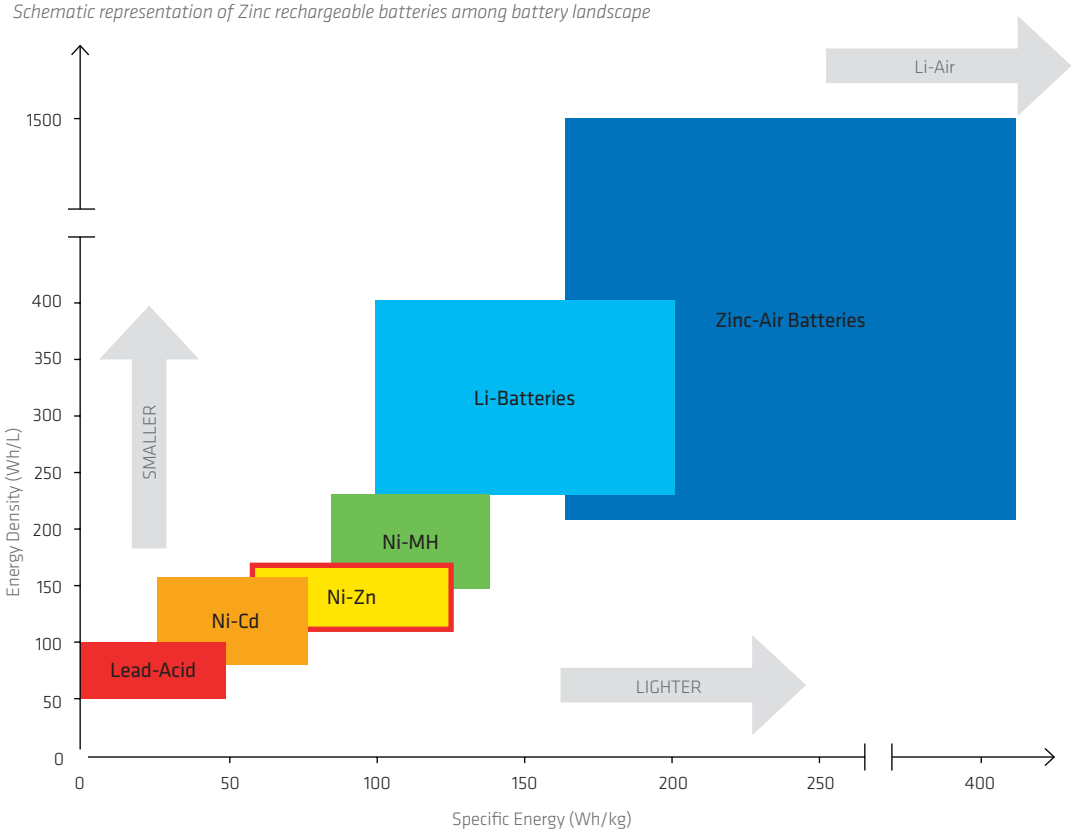
GIANT EFFECT

For its research on zinc anodes, Easyl depends on GIANT partners Grenoble-INP, CNRS, and UGA.



Global battery industry growth by application and region by 2030.

Schematic representation of Zinc rechargeable batteries among battery landscape



New bio-sourced additives **improve the "wet and dry strength"** of **PAPER PRODUCTS**

Researchers at the CNRS laboratory CERMAV in Grenoble have found a way of improving the wet strength of paper-based products, using additives made only from bio-sourced materials.

#Fundamental Research — #Industry

If you have ever packed something in a cardboard box that then got so wet it could no longer hold the contents, you understand the concept of wet strength.

Wet strength is a measure of how well paper and similar fabrics can resist force when wet, and is usually expressed as the ratio of wet to dry tensile force at break.

The solution invented by the CERMAV researchers is unique in its combination of the use of environmentally friendly materials and processes and the resulting wet strength. Now the researchers are ready to take their products and related services to market.

They began the process of industrialization in December 2017 by setting up FunCell and having it incubated by SATT Linksium, with the support of CERMAV. The next step is to establish FunCell as an independent legal entity—something they plan to do in June 2020.

Named by using an abbreviation for *"functionalization for cellulosic materials"*, FunCell has already established working relationships with paper mills and other industrial partners, where they hope to apply their additives to papers, boards, and tissues. With improved wet and dry strength, the resulting products will have a number of applications—including shopping bags that are both strong and recyclable, and cardboard boxes that don't fall apart when wet or humid. What's more, the resulting products will be environmentally friendly.

A photo of a paper with (left) and without (right) the additive in stirred water. With the FunCell additive the paper stays intact compare to the other.

On top of the additives, FunCell will offer consulting services to help large manufacturers produce cheaper, stronger, and more recyclable paper-based products. This expertise comes from years of working in the CERMAV lab, conducting leading edge research in glycoscience. Glycoscience is a field of research into glucides (sugars, oligosaccharides and polysaccharides, glycopolymers, and glycomaterials). CERMAV focuses specifically on the synthesis, characterization, and industrial application of glucides in a number of domains.

"Our technology uses bio-sourced macromolecules and relies on biomimetic approach to enhance cellulose-to-cellulose interactions in both wet and dry conditions," says Laurent Heux, deputy director of CERMAV and one of the two inventors and founders of FunCell. *"These additives increase the wet-dry ratio up to 60%."*

Julien Leguy, who defended is PhD at CERMAV with Dr Heux, joined the adventure as of February 2019. Along the way, he won the 2020 eidtion of the prestigious i-PhD prize, which is awarded for innovation to young doctoral candidates and those who have recently received a PhD.

"Our team is specialized in the study of polysaccharides," says Heux. "This includes not only understanding the organization of polysaccharides, but also their potential use in the synthesis of new materials that have industrial applications.

We've been doing this research for years, which gives us a unique set of skills and know how that we hope will improve paper-based products in an environmentally-friendly manner."

“Thierry URING

connects people on the GIANT Campus”

Grenoble's ecosystem of researchers, educators, and industrial players probably wouldn't be as dynamic without Udimec, an association of more than 600 businesses of all sizes, making up a total of almost 55,000 employees.

The head of Udimec, Thierry Uring (whose official title is "General Delegate"), makes sure member companies stay close to the researchers and educators from the 8 GIANT institutes. Udimec firmly believes that making connections is of benefit to all people and organizations involved.

Thierry first came to Grenoble to do his studies at Grenoble-INP. He admits that his passion for skiing played a role in his choice of schools—and his love of the local cuisine, including tartiflette and gratin dauphinois, has helped keep him here.

Q What kinds of enterprises are in your group and how do you work with them?

There are around 20 big companies, including ST Microelectronics, Schneider Electric, Caterpillar, HP, Siemens, and Thales—and we have about 500 small to medium businesses. Our member companies operate in a variety of sectors, and all of them are present in the Isère department—many around Grenoble and Voiron, but also some in Bourgoin-Jallieu and Saint-Marcellin.

We have a team of experts who offer three types of service to our members. The first is legal services. We have 8 lawyers who help member companies with labor and social law—and sometimes even mediation.

The second service we offer is training, helping develop talent within member enterprises. We have two training centers of our own, and we also partner with Grenoble INP for work-study programs. We offer a number of degrees from technical high school degrees to engineering degrees, and we offer work-study programs as well as executive education.

And the third service is finance. We help members get credit and credit insurance—and we provide billing services. We also provide venture capital through an entity called *"Rhône Dauphiné Développement"*—and we help out with company creation as well as with mergers and acquisitions.

Beyond those three services, one of our important roles is to bring people together—to connect researchers, schools, and industrial players.

Q How does Udimec work with GIANT?

Some of our member companies are located on the GIANT campus, including two of the big ones, Schneider Electric and STMicroelectronics, and a small one, Xenocs, who specialize in nanotechnology. They are attached to two centers of excellence – Minalogic, which is part of Minatec, and Tenerrdis, which we ourselves host.

We have ongoing partnerships with Grenoble INP, CEA, and ESRF that involve facilitating exchanges between some of the industrial players and the researchers and educators. As a group of industrial players, we think that innovation is key—and that means not only technological innovation, but also other forms, including process and organizational innovation. So we certainly look to the GIANT institutes for help in these areas.

Of course, this works in two directions: We also help the researchers and educators at GIANT get closer to the industrial players, to understand what's happening on the front lines.

Very often people and organizations don't get to know one another well enough—and that's a shame. I think they would benefit from getting out of their silos. To ensure our future, the future of business and research, we need to open doors. The researchers need to take the time to come into businesses to see what's happening there; and the executives and technologists of the businesses need to spend time in the research centers and take advantage of the latest innovations.

This is why I think GIANT has a great future, as a catalyst for research, education, and business. The more we all work together, the more we all gain, and that's the driving philosophy of Udimec.

Working with GIANT helps us connect people.

- GIANT - CAMPUS *LIFE*

PROGRAMS AND EVENTS ALL YEAR LONG

January 2020

MIT GLOBAL TEACHING LAB (GLT)
MIT students conduct learning by doing course work in local high schools

Y.SPOT GRAND OPENING
Inauguration of the new set of buildings dedicated to open innovation, in the heart of the GIANT Campus

February 2020

SCIENTIFIQUE TOI AUSSI (STA)
a day for high school students to explore scientific professions and discover the work environment in laboratories

April 2020

FOSTERING DAYS PART 1
Fostering Ideas

May 2020

FOSTERING SCIENCE
Audition preparation (StG 2020)

GIANT REVIEW – SPRING 2020 ISSUE
New GIANT Innovation Campus's scientific magazine issue

June 2020

AFFICHE TA SCIENCE (ATS)
A school competition for the best scientific posters and videos

June 2020

FRENCH AMERICAN WORKSHOP (FAW)
The Annual Meeting of the French and American scientific communities, supported by the US consulate in Lyon and the French Science mission in Washington DC

FOSTERING DAYS PART 2
Writing workshop and clinics

LES ASSISTANTES AU CŒUR DE L'ÉVÉNEMENT
Workshop dedicated in helping executive discover how tomorrow's technologies will change their jobs and provide them with a new set of tools

September 2020

GIANT REVIEW – FALL 2020 ISSUE

New GIANT Innovation Campus's scientific magazine issue

AUTOMN GIANT

International Internship Programme (GIIP): GIANT welcome day for international students staying 3 months on campus

FOSTERING SCIENCE

Audition preparation (SyG 2019 & CoG 2019), writing workshop and clinics for StG 2020

October 2020

PARVIS DES SCIENCES

A three-day festival dedicated to science, research and innovation for school kids and citizens

GRENOBLE EKIDEN BY GIANT

A six person marathon relay race open to everybody to discover GIANT Campus while runing and having fun with family, friends and colleagues

November 2020

WELCOME DAY

Orientation day for new GIANT PhD students

HIGH LEVEL FORUM

An international GIANT event for leading innovation ecosystem, with a 2020 edition taking place in Grenoble dedicated to « Innovation Ecosystems: key-players in re-inventing Industry »

December 2020

LA RECHERCHE FAIT ECOLE (RFE)

A full-school year programme dedicated to raising awareness of scientific professions for local middle school pupils

All-year round

GIANT@SCHOOL, Start-up Café and GIANT afterworks, Midi MINATEC, HIGH LEVEL VISITS, GIANT Communities meetings and projects, GIANT Campus introductions, GIANT newsletters and MINAnews, Etc...

TO GET ALL THE INFORMATION ABOUT GIANT NEWS, EVENTS AND PROGRAMS, JOIN US ON
OR VISIT WWW.GIANT-GRENOBLE.ORG

GIANT

AT A GLANCE

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