

MINA-NEWS

MINATEC
NEWSLETTER
APRIL '19



This issue contains
two "April Fool's" articles.
CAN YOU FIND THEM?

TOP NEWS

AIDS vaccine: Lipidots® open the door to a novel approach

Researchers from Leti, CEA Sciences, and INSERM injected Lipidots® (lipid-based nanoparticles) containing the p24 protein of the Human Immunodeficiency Virus (HIV) into an animal model and obtained a robust and complete immune response.

Lipidots® were created by Leti and CNRS in 2006 to encapsulate and deliver drugs or fluorescent chemical compounds to "target" cells. The lipid-based nanoparticles are easy to produce on a large scale, stable, and well-tolerated by the human organism. They are protected by a total of fourteen patents.

ANTIBODIES AND T-CELLS

Recent research to investigate a novel approach to an HIV vaccine could give Lipidots® a new use. The researchers grafted the p24 protein, a fragment of the HIV viral capsid, and immunostimulants onto the lipid-based nanoparticles. They obtained the production of a large number of antibodies and a very strong T-cell response.

The size of the Lipidots®, which measure just 100 nm in diameter, was a plus. The tiny Lipidots® can effectively enter the lymphatic vessels and reach the nodes, where the immune response is triggered. The next step will be to experiment with a broader approach by encapsulating several antigens. The road to an AIDS vaccine that is effective in humans remains long. This latest advance could help get there faster.

✉ fabrice.navarro@cea.fr

INNOVATION

Changing the magnetic chirality of skyrmions

The skyrmion—a magnetic quasiparticle measuring just a few nanometers—continues to garner great interest in the world of spintronics. Researchers from Spintec, Institut Néel, and LSPM* recently demonstrated that the interaction that sets skyrmion chirality (or spin direction) is modulated in a linear manner by lattice tension. If the tensions studied are extrapolated further, it appears that the phenomenon could ultimately change skyrmion chirality. If this discovery is accurate, it would make the skyrmion, used as a magnetic logic unit, easy to manipulate by applying tension.

The research is continuing under a project funded by the French National Research Agency and is now focusing on applying greater tensions and confirming that tension can indeed reverse spin direction. The researchers would also like to conduct further investigations into the irreversibility obtained when tension is applied for longer periods.

*Process and Materials Science Laboratory (CNRS)

✉ helene.bea@cea.fr

Getting closer to denser, more energy-efficient RRAM memory

A team of researchers from Leti working in partnership with Stanford University recently developed a resistive RRAM memory technology with 2.5 times the storage density of conventional flash memory. Instead of using binary coding (high or low resistivity), information can now be assigned five different values. This advance was made possible by materials and read/write mechanisms capable of exploiting intermediary resistivity states.

The RRAM memory developed also uses much less energy than current flash memory during the write phase, making it a high-performance non-volatile system. A neural network demonstrator system built on the technology was presented in San Francisco in February. The partners have published three papers on their findings. They now hope to obtain eight—and possibly even sixteen—values per memory point.

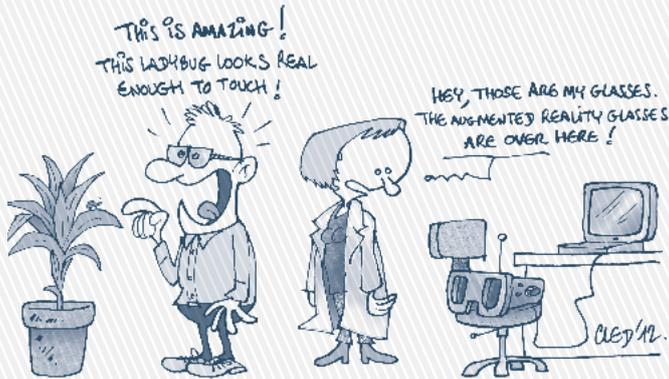
✉ elisa.vianello@cea.fr

Progress toward high-performance UV LEDs

Doping the materials that make up the barrier around a UV LED's active region is challenging, which makes it difficult to improve the yields and lifespans of UV LEDs at the 265 nm wavelength. Researchers from INAC and Institut Néel are tackling the subject, and their work under a French National Research Agency-funded project recently resulted in a significant advance. The team added a small fraction of indium to the doping material, magnesium. At the same time, they used aluminum nitride nanowires (rather than thin layers) for better relaxation of the strain generated by the dopant. The technique increased the maximum solubility of the magnesium tenfold.

The researchers would like to move on to a prototype. As mercury is gradually phased out, 265 nm LEDs will be used increasingly in applications like air and water disinfection and counterfeit bill detection.

✉ bruno.daudin@cea.fr




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The module could potentially lighten the load of a central processor by completing value-added tasks like detecting anomalies, focusing on areas of interest, and capturing moving objects, in its place. Leti has filed several patents and is currently working on a second generation of the technology.

✉ laurent.millet@cea.fr

Three potential new pathways to augmented reality glasses

So far, augmented reality glasses have failed to live up to their promises: They are bulky, their field of view is limited, and they are not bright enough to be used outdoors. Leti is working to overcome these limitations through three targeted R&D projects.

First, the institute is developing a 853 x 500 pixel, three-micron-pitch gallium nitride display to enhance brightness. A monochromatic display has already been completed, and a full-color version is in the works. Next, Leti is leveraging Pixcurve's curved display technology to come up with more compact optics. Finally, Leti researchers are combining optics and holography to project high-definition images directly onto the retina. These new developments will help deliver a truly immersive experience!

✉ stephanie.le-calvez@cea.fr

Neural networks: Keeping catastrophic forgetting at bay

To effectively respond to situations they have never learned before, tomorrow's neural networks will have to keep a phenomenon known as "catastrophic forgetting" at bay. Catastrophic forgetting occurs when a new set of data "overwrites" previous data instead of adding to it.

Researchers from Leti, List, and LPNC* recently developed a novel solution to link knowledge in natural intelligence with knowledge in artificial intelligence. They created a model made up of two neural networks: The first network learns a given number of events, and then sends a sampling of the knowledge it has acquired to the second network. The second network then combines the sampling with new events and sends the information back to the first network. The result is a kind of incremental learning that is very close to how human memory works.

A combined research project (Instituts Carnot and a PhD dissertation) kicked off in October 2018 to evaluate this dual network's capabilities.

*Psychology and Neurocognition Laboratory (CNRS, UGA, Uds)

✉ marina.reyboz@cea.fr

Retina: 3D-integrated image processing

Researchers from Leti made a significant technological advance when they completed the 3D integration of a 1024 x 768 pixel imager and a 192 multicore-processor chip. The two components are stacked and physically and electrically connected by direct bonding of their metal layers. The pixels integrate the read and scan electronics. The 3D assembly enables massively parallel interconnection of the pixels to the processor array. The demonstrator, which was given the name Retina, boasts enough processing power to handle 5,500 images per second.

It's amazing what a little spin pumping can do

In 2016 researchers at Spintec used spin pumping to study spin fluctuations in ultra-thin layers. More recently, they joined forces with other researchers* to show that the method is generic in nature. In other words, it is effective regardless of whether an electric or magnonic current is used to transport the spin and regardless of whether the phase transition is of the ferromagnetic to paramagnetic or antiferromagnetic to paramagnetic type.

The research investigated several combinations of spin injecting and absorbing materials (spin pumping occurs from one to the other). This advance will make it easier to characterize the order of materials in nanolayered materials. Until now, characterization required advanced lithography techniques.

*LPS Orsay, OPTIMAG Brest, CIME

✉ vincent.baltz@cea.fr

Le 3D-Onochip project reports first findings

The 3D-Onochip* project (run by two industrial companies and two Grenoble Institute of Technology labs** and backed by the French Single Interministerial Fund) recently reached an important milestone. Microlight3D, one of the industrial companies involved in the project, successfully printed 900 x 900 x 300 μm cytoskeletons in 96-well plates with excellent process reproducibility. LMGP then deposited growth factor onto the cytoskeletons and tested their mechanical resistance and ability to withstand sterilization.

CTI Biotech, the other industrial partner on the project, could ultimately deposit cancer cells onto the cytoskeletons to obtain 96 identical microtumors. Microtumors can be used as biological models in the development of new treatments and to help clinicians tailor personalized treatments for individual patients.

*Supported by the Greater Grenoble Intermunicipal Authority

**LMGP and the Jean Kuntzmann Laboratory

✉ denis.barbier@microlight.fr

Correct your posture right from your phone

Posture-correcting garments equipped with lumbar and shoulder retractors have been around for five years. A new generation of the garments based on microtechnology could be just around the corner. Researchers at Leti are investigating the integration of NEMS accelerometers and artificial neurons made up of a few dozen transistors into textile threads. When distributed throughout the garment, the components could reconstitute the wearer's "posture signature" in real time. Posture information, monitoring, and alerts would be sent to the wearer's phone.

Proven solutions like the one developed by Primo1D have made it possible to integrate RFID tags into textile threads. However, the artificial neurons the researchers would like use here are much larger.

✉ frederic.heimann@cea.fr



EuroSOI-Ulis conference reaches out to broader audience

The fifth combined EuroSOI-Ulis conference will be held on April 1 to 3 at Maison MINATEC. EuroSOI is right up there with S3S (held in the United States) as one of the world's top SOI* events. This year's EuroSOI will address topics including the most advanced form of SOI, FDSOI, and radiofrequency applications for SOI. Ulis will explore technologies for the ultimate miniaturization of transistors, for architectures, and for materials targeting innovative applications.

IMEP-LAHC, Grenoble Institute of Technology, and Leti are organizing EuroSOI-Ulis 2019, which will bring in around 100 people—mainly researchers, but some industrial professionals as well. The audience has been largely European in previous years. This year, however, a significant number of attendees from Asia and Russia are expected.

*Silicon-on-insulator, made by Soitec, among other manufacturers

✉ maryline.bawedin@phelma.grenoble-inp.fr

Bernard Diény earns IEEE recognition

The IEEE Magnetics Society Career Achievement Award 2019 was given to IRIG (formerly INAC) researcher and Spintec cofounder Bernard Diény in Washington.

The award has traditionally gone to the greatest minds in international magnetism research: Bernard Diény is certainly no exception, with a total of 430 publications and 70 patents to his name. He played a pivotal role in the emergence of the giant magnetoresistance spin valves that long equipped hard drive read heads. And his team made substantial contributions to the convergence between magnetism and microelectronics, as well as to the success of MRAM magnetic memory technology, which was adopted by manufacturers like Samsung, TSMC, and Intel. Currently he is investigating new MRAM memory concepts and magnetic logic components.

✉ bernard.dieny@cea.fr

Cinatec endowment fund to support four projects

Four research projects submitted under the Edmond J. Safra 2019 call for proposals have been selected to receive a total of €900,000 in support from the Cinatec endowment fund. The projects were evaluated by the endowment fund's international scientific committee.

The winners are: the Cooling project (treating epilepsy with cold); the NIR project (stopping the progression of Parkinson's disease using near-infrared light); the BCI project (a thought-controlled exoskeleton for tetraplegics that will be clinically tested on three new patients in 2019); and the Hypnote project (identifying changes in central and peripheral nervous system activity related to the hypnotic trace state).

✉ lisa.carvello@cea.fr

Phelma rises 31 slots in the *L'Usine Nouvelle* rankings

Grenoble Institute of Technology engineering school Phelma made an impressive leap in the *L'Usine Nouvelle* magazine 2019 rankings, rising 31 slots to number 15. The weekly magazine publishes an annual ranking of 130 engineering schools based on career placement, international programs, research, and entrepreneurship.

Phelma earned points for career placement, thanks to a rising median gross annual salary (€35,864), a growing percentage of alumni employed under permanent contracts, and the fact that

recent grads very rapidly find their first jobs (86% within two months of graduation).

In terms of its international programs, Phelma also did well, with 31% of students studying abroad and 44% completing at least a one-semester internship in a country other than France.

✉ alexis.sableaux@phelma.grenoble-inp.fr

Student entrepreneurs: Phelma engineering school home to four projects

The French government created a special "student entrepreneur" status in 2014, and students at Grenoble Institute of Technology's Phelma engineering school continue to take advantage of it! This year, the school is home to four projects led by five second- and third-year students. The student entrepreneurs are receiving support from OZER, an organization set up specifically for this purpose. They also benefit from modified course loads and academic tutoring.

The most mature of the projects is Reveho, a modular, self-amplifying guitar that can be disassembled for travel. Project lead Alexandre Albisser is now on his second prototype. Another project, Solar Solution, is developing a self-powering solar drone. Culture Jo' is developing an arts-themed board game with an associated app. Finally, Glob'Ems is an electronic system to centralize motorcycle operating parameters (RPM, temperature, etc.) and functions.

✉ christian.guicherd@grenoble-inp.fr

Challenge First Step 2019 kicks off

The Challenge First Step 2019 competition official kick off was held at the March 21 Startup Café. The competition was created in 2012 to help identify potential "out of the box" tech-transfer ideas, nurture them into viable projects, and speed up the incubation phase. Any permanent CEA Grenoble staffer with an idea for a startup is welcome to enter. Over the past few years, the competition has helped produce some promising ventures, including Scintil Photonics, Wattalps, PowerUp, and SEED Energy.

The deadline for submissions is end of business on May 3; candidates will be interviewed in mid-May. The winners selected by the jury will be offered a range of support services. Later, depending on how advanced their projects are and their expressed needs, they may be eligible for financial assistance.

✉ sylvain.colomb@cea.fr

Leti Innovation Days gets new format

Leti Innovation Days 2019 is adopting a new format, with five days of events (up from two previously) to be held at MINATEC from June 24 to 28. An impressive 2,000 people from around the globe are expected to attend.

The week will offer up a complete program of lectures, panel talks, workshops, and tutorials on semiconductor technologies for embedded artificial intelligence. Attendees—whether they are CEOs, CTOs, or line managers—are free to pick and choose from the broad range of events on the agenda.

Speakers will include the CEOs of organizations like Inria, Applied Materials, and STMicroelectronics Digital Group; the Vice Presidents, Strategy of companies like Toshiba, Atos, and Facebook; startup founders (Gyr Falcon Technology, Mythic,



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and others); and 2010 Fields Medal winner Cédric Villani. Villani's talk will be open to the general public and broadcast live on Leti's website.

See the program and register at <http://www.leti-innovation-days.com/>

✉ michael.tchagaspanian@cea.fr

Leti and the Instituts Carnot: A synergistic relationship

Leti staff members have traditionally held key positions within the Instituts Carnot organization, a network of 38 government research organizations established in 2006. Today, the tradition continues with the appointment of Leti Program Director Susana Bonnetier as Vice President of the Carnot Network. As Vice President, one of her priorities will be to ramp up the Network's communications, with more events, a greater online presence, and a name that is easier to understand ("Carnot").

Carnot matching funds are vital to Leti's pump priming research. The institute uses the funds to investigate breakthrough technologies, complete proof-of-concept testing on key enabling technologies, and explore future markets. Finally, Carnot support also benefits startups through programs like the Challenge First Step competition.

✉ susana.bonnetier@cea.fr

LIVE FROM MINATEC

CEA introduces vermicomposting to reduce biowaste

The CEA, a member of sustainable catering organization CIEC*, is rolling out a strategy to make MINATEC's three food service locations more environmentally-friendly. The strategy aligns with the "Virage à Table" ("Turning the Tables") project, which won the French government's National Food Policy 2018-2019 award.

The first step in the strategy will be to install two 15 cu. m vermicomposters (slated for completion in mid-April next to building H3) to recycle biowaste. The campus' three kitchens generate a whopping 2.6 tons of vegetable peelings and food scraps per week, based on 20,000 meals, each generating 130 grams of organic waste. The worms will digest all of that waste into a 100% natural fertilizer made up of solid compost and liquid vermicast—yes, worm juice! CEA employees are welcome to help themselves for as long as supplies last!

*An organization of local governments and other institutions

✉ bruno.renard@cea.fr

BHT2 to open its doors this fall

Construction of the BHT2 building was completed right on schedule at the end of March. MINATEC Entreprises, which manages the building, is in late-stage negotiations with around ten companies that have expressed an interest in locating their operations there.

The interior spaces will be designed and built out to meet each tenant's needs over the summer so that the tenants can start moving in this fall. The new building has four stories of modular office, lab, and cleanroom spaces and one floor to house technical equipment and facilities.

Because the building is outside the access-controlled perimeter of the CEA, a manned reception desk will be provided to direct visitors. CEA security officers will be assigned to the building.

✉ jp.boncristiano@minatec-entreprises.com

LIVE FROM MINATEC

GIANT Orientation Day for young researchers

The GIANT Junior Ambassadors will welcome the campus' PhD candidates, post-docs, and interns to the first-ever GIANT Orientation Day on April 15. The event is designed to give the participants a comprehensive overview of GIANT's activities. And, with an impressive 30,000 people specializing in ICTs, energy, and healthcare working and studying on the campus every day, participants will also get a prime opportunity to expand their local networks.

After a morning session of presentations and a serious game at Maison MINATEC, participants will be able to choose one of four tours: A tour of the CEA (showroom, FabLab, and a MINATEC startup); a visit to ESRF/Institut Laue-Langevin/STMmicroelectronics; a healthcare tour at Clinatex; or an energy tour (Liten/GreEn-ER/Schneider Electric).

The event will be run in English and is free of charge. GIANT plans to put this new day on the agenda every year!

✉ hermine.vincent@cea.fr

MINATEC startups raised more than €125 million in 2018

When it comes to fundraising, 2018 will go down in the books as a record year. Ten MINATEC startups raised €30 million in 2017. In 2018 nine startups raised more than €125 million.

Three of the startups (Isorg, Aledia, and Kalray, which went public last June) raised more than €20 million each. The six others ranged from €253,000 for Moovlab to €10.5 million for ISKN.

The dramatic increase speaks to the vibrant local tech ecosystem, of course. However, a broader national context favorable to deep tech startups also explains the huge amount of capital raised. A decade ago a startup raising more than €10 million would have made the headlines. Today, given the multiple sources of financing now available, it is much more common.

✉ sylvain.colomb@cea.fr

MINATEC Labs make room for 100 more researchers

The Vercors Wing of building 10.05 is finally ready for moving day after two years of construction work. Nearly 100 nanoelectronics, nanophotonics, and spintronics researchers from CEA Sciences/IRIG will start moving in this April. Some 200 researchers have already moved into the Chartreuse Wing of the building. Once the Vercors Wing is occupied, MINATEC Labs will be home to most of the early-stage digital technology research taking place at the CEA's Grenoble campus. The equipment at the Upstream Technology Platform* and chemistry platforms will also be moved.

The researchers concerned will move in gradually through the fall, ending with the quantum nanoelectronics teams. Their cryostats can be up to three meters tall and are equipped with extremely sensitive instruments accurate down to the mK—not the easiest items to move! This state-of-the-art equipment will be installed in pits to make the cryogenic arms easier to maneuver.

*PTA (Plateforme technologique amont)

✉ emmanuel.hadji@cea.fr



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INTERVIEW

JÉRÔME GARIN,
Director, IRIG*

"We are working together to address interdisciplinary topics"

MINA-NEWS: INAC, BIG, and IBS merged to form IRIG in early 2019. What is the rationale behind the change?

Jérôme Garin: The idea is to scale up, raise our profile, and present a unified front to our partners like CNRS and the University. With a staff of 1,000, we are close in size to Grenoble's other major research organizations. Another important goal is to make it much easier for our biology, physics, chemistry, cryogenics, and mathematics researchers to collaborate on interdisciplinary topics. IBS and BIG had a long-standing relationship prior to the merger, so many of our researchers already know each other. We just want to take things further.

MINA-NEWS: Aren't you concerned about people spreading themselves too thin?

JG: Not at all. It is quite the opposite, really. Today's scientific challenges are being addressed by researchers from all of our disciplines. Let me give you an example: It is getting harder and harder to do biology without bringing mathematics into the picture. The new organization reflects that reality. But it has also left our research teams intact. The existing ten Joint Research Units** will remain exactly the same.

MINA-NEWS: How will you promote interdisciplinary research on the ground?

JG: We have already issued a call for projects to generate new interactions between our disciplines. We also plan to communicate much more within the organization. We will hold on-site meetings, events for our PhD candidates, and other activities to give our researchers opportunities to get to know each other and get familiar with each other's work. IRIG is a diverse place, and it is up to us to find ways to bring people together.

*Grenoble Institute for Interdisciplinary Research

**Multi-partner research units overseen by the French National Center for Scientific Research (CNRS)

✉ jerome.garin@cea.fr

HORIZONS

Could light and heat soon power the Internet of Things?

IoT (Internet of Things) components don't like to be tethered by cables! So, instead of plugging them in, why not harvest energy from the ambient heat and light? The five-year EU Harvestore project, which kicked off in late 2018, will develop just such a solution. LMGP is assigning one of its PhD candidates and a post-doc to the project.

The highly-miniaturized systems to be developed will deliver between 0.5 mW and 10 mW of power. They will include both energy harvesting and storage capabilities. The researchers in Grenoble will work on improving the ceramic and oxide materials likely to be used, performing advanced materials characterization at the Synchrotron, and develop deposition techniques. So far, it looks like the target system will consist of a reversible micro-fuel-cell combined with photovoltaic cells. It will be the first-ever system of its kind on this small a scale.

✉ monica.burriel@grenoble-inp.fr

Avalun's pocket lab a success in retirement home test

The first phase of remote healthcare project e-Meuse, carried out in late 2018, was a success for startup Avalun's LabPad INR pocket lab. The device helped save caregivers time, increase patient comfort, and shorten response times in the event of an abnormal test result. The device, which can perform a coagulation test from a single drop of blood, was at the center of the system being tested. It was used to perform regular blood tests on 30 retirement home residents over a period of three months. All of the test results were sent electronically to testing lab Syndibio for confirmation.

A team of researchers from Leti helped coordinate the project, which also involved local healthcare administrators and elected officials. Another testing campaign is currently being planned with several Grenoble-based biotech startups.

✉ sandra.barbier@cea.fr

Michelin acquires stake in Primo1D

Primo1D just completed its second round of fundraising, bringing in €6 million from investors confident in the company's unique technology, which places antenna components and a RFID tag inside a special yarn, which can then be integrated into materials like textiles, plastics, and rubbers. The company's new shareholders include Michelin Ventures, the global tire leader's VC fund. This is the first time that Michelin Ventures has announced one of its investments publicly.

Primo1D plans to hire seven employees this year and complete R&D work on four projects already underway (for tires, electric and fiber optic cable, rope for farming applications, and the apparel industry). This will be the year that Primo1D scales up its technology to prepare for volume manufacturing starting in 2020. The company will continue to focus on R&D as well, and has just renewed its joint lab with Leti for an additional three years.

✉ emmanuel.arene@primoid.com

Morphosense raises €2 million in fresh capital

Startup Morphosense just reached a major milestone in its development, raising €2 million from three investors, including Bouygues Construction. The company will grow from eleven to sixteen employees this year and will complete development work on the second incarnation of its product, Neuron. Morphosense will also continue to work with Leti on machine learning.

The company develops instrumentation that monitors the structural health of offshore oil and gas platforms, floating wind turbines, and other infrastructures in real time. The underlying technology is the fruit of ten years of R&D by Leti. The company is currently developing advanced algorithms it hopes will be able to detect the weak signals that occur before any damage to a structure is present. This future technology will help effectively target predictive maintenance and lower maintenance costs.

✉ alexandre.paleologue@morphosense.com

– The posture-correcting garment with NEMS accelerometers and artificial neurons. While it is true that Leti is working on embedded artificial intelligence, scientists are still far from being able to integrate artificial neurons into thread. Posture-correcting garments with retractors do exist, however, consumers will have to wait a while for self-learning ones!

– New 15 cu. m vermicomposters next to the H3 building. For worms to digest 2.6 tons of food waste per week, the waste would have to be spread over hundreds of square meters and it would take months to produce compost. This is simply not realistic on the MINATEC campus. But you can try setting up your own (smaller) worm farm at home!

AND THE APRIL FOOL'S ARTICLES ARE...



AGENDA

April 3–5 [maison MINATEC]
EUROSOI-ULIS 2019 CONFERENCE
<https://eurosoiulis2019.sciencesconf.org/>

April 3–5 [Grenoble]
INTERNATIONAL NANODEVICES AND
COMPUTING CONFERENCE
<http://icrc.ieee.org/>

April 4 [MINATEC]
SESSION 2 OF INNOTECH WITH
LOCAL HIGH SCHOOLS
nathalie.mathieu@phelma.grenoble-inp.fr

April 15 [GIANT]
GIANT ORIENTATION DAY
hermine.vincent@cea.fr

May 3
SUBMISSION DEADLINE FOR THE
CHALLENGE FIRST STEP 2019
COMPETITION
sylvain.colomb@cea.fr

May 27–June 7 [Les Houches]
SPRING SCHOOL ON "BIOLOGY AT
DIFFERENT SCALES"
run by IRIG/IBS
<http://leshouches.strikingly.com/>

June 3–6 [Grenoble]
GLOBAL CHALLENGES SCIENCE WEEK
<https://edu.univ-grenoble-alpes.fr/science-week>

June 13 [MC2 Auditorium, Grenoble]
NATIONAL FINALS
OF THE THREE-MINUTE THESIS
COMPETITION
<http://mt180.fr/>

June 24–28 [Grenoble]
LETI INNOVATION DAYS 2019
michael.tchagaspanian@cea.fr

CONTACTS



MINA-NEWS is published by MINATEC 3, parvis Louis-Néel – 38054 Grenoble cedex 9, France

Head of Publication: Jean-Charles Guibert - **Editor-in-Chief:** Julie Spinelli

Contributors: Camille Giroud, Leti, camille.giroud@cea.fr

Nathalie Mathieu, Phelma, FMNT, nathalie.mathieu@phelma.grenoble-inp.fr

Patrick Warin, INAC patrick.warin@cea.fr, Julie Spinelli, MINATEC, julie.spinelli@cea.fr

Alexis Sableaux, Phelma, alexis.sableaux@phelma.grenoble-inp.fr

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