

DOUBLE-
PAGE ON CYBER-
SECURITY

R/V
PAGE 18



UTC'S INAUGURAL LECTURES

Establishing a prime
contact between students,
science and high-level
research

Page 2

HEALTH AT WORK

An exoskeleton to
combat back-ache

Page 16



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Donnons un sens à l'innovation

Interactions

UTC DOSSIER

Food innovation at the heart of future health concerns

UTC'S 2019 GRADUATION CEREMONY PAGE 14

JEAN-LOUIS CHAUSSADE
A CONFIDENT GODFATHER

YOU HAVE THE FLOOR PAGE 15

EDUCATION & NUTRITION
STEPHANIE DAMERON,
RECTOR REGIONAL ACADEMY, AMIENS





EDITORIAL

Author Gaston Bachelard, in his essay « La formation de l'esprit scientifique » [training of scientific minds] opined that "having a scientific mind forbids us to holding an opinion about questions we either do not understand, or do not know how to frame clearly. And above all, we must learn how to frame problems. And no matter how we discuss the matter, in a scientific life, problems cannot frame themselves".

In our series of inaugural lectures (academic year 2019 seeing the second edition), we invited field leading scientists to present their questions, and how they frame problems on certain topical themes and issues. The public of our young Baccalaureate holders is among the most reactive to the numerous questions raised – often addressing the underlying issues themselves.

And had we been able to illustrate Gaston Bachelard's vision above, we would have fulfilled our first objective as training professionals. But we also pursue the ambition – at a time when the floor given to a global warning 'negationist' can be every bit as generous as that given to hundreds of experts who contribute to the IPCC Report as we saw in the decade 2000-10, i.e., we are seeking to illustrate scientists' work as they tackle societal problems. This year we have scheduled 3 inaugural lectures and readers of Interactions will be able to see the portraits of the 3 lecturers and some of their scientific activities and I know that this only represents a very small fraction of the scope possible.

Long live science !

Prof. Philippe Courtier
President & Vice-Chancellor, UTC



UTC'S INAUGURAL LECTURES

A precocious passion for nature

Luc Abbadie, not only is a tenured professor at the Sorbonne Universities cluster and research scientist in Department called "Community diversity and eco-system operation", but also Vice-President of the Scientific Advisory Committee (CS) of the French national Agency for Biodiversity (AFB) and a Member of the Foundation for Political Ecology. He delivered one of the three UTC Inaugural Lectures.



At the outset of his passion for natural science and nature, one meeting was decisive. It was with a monitor, who, watching a very young Luc Abbadie, busy observing a fossil displayed in a wall cabinet said to him "This a very precious item – it tells us a lot about the history of nature itself."

Thus, with his scientific Baccalaureate, he decided to do a Master's Degree (M1) in the field we used to call "natural science" [in France] or Biology [in the UK] "Since we were keen on ecology and the environment, it seemed necessary that we had a wide-ranging scientific culture and the advantage of this area was that we were notably studying biology, geology and physics", he explains.

Another important meeting was during the 'DEA' year (Master's degree (M2) and was with Maxime Lamotte, a leading figure in ecology, Director of an ENS/University of Paris 6 (Pierre & Marie Curie) Joint Laboratory, which proved to be every bit as decisive in his commitment in favour of the environment and ecology, both as an academic and as a citizen.

So, for his PhD he was assigned to a special field station in Côte d'Ivoire to study tropical ecosystems after creating in the 1970s an association "Nature

& Société", still active today.

Since those days, he passionately pursues studies in the same area, totally committed to fighting for ecology and to protect biodiversity.

"When you get interested in biodiversity, it is equivalent to analysing and assessing variability in living matter. Diversity is often measured – and it is easiest approach - in terms of species. It is estimated that there are some 1.8 M species in the world. In all likelihood there are many more. Some experts even talk of 10 M species", explains Luc Abbadie.

Today, this biodiversity is at risk. Did the 2019 IPBES Report (the equivalent for IPCC for biodiversity not pinpoint an "unprecedented, accelerating, extinction rate of species"? Of course there were other extinction crises à other times in the past. These are well documented, especially from oceans and with sea-bed fossils, and this proves less random than with land-based sources. But the ongoing, drastic and unprecedented reduction of species has never seen its equivalent in the past. "Less well-known to the public at large is the effect of biodiversity on the climate change", adds Luc Abbadie.

And among the reasons for this drop in biodiversity? "Well we can single out agriculture and stock-raising that occupy 1/3 of emerged land and in the oceans and seas we clearly see the results of over-fishing and depletion", he stresses

So, how could (should) we remedy this situation? "Firstly, we should choose a reasoned exploitation of resources. We are going to have to change our model of agriculture, especially since the FAO forecasts a 50% increase in agricultural production by 2050. Secondly, we must stop opposing biodiversity and productivity. Numerous studies have proven that the more we increase biodiversity, the more we increase productivity. Take the case of rice. Experiments conducted in China, where a few rows of 'sensitive' rice were alternated with a row of resistant rice, demonstrated a reduction in pathogens and a decreased dispersal rate. Drought-periods would also be better avoided," concludes Prof. Abbadie. ■ MSD

SO WHAT ARE
THESE INAUGURAL
LESSONS?

The introduction of inaugural lectures at the beginning of the 2018 academic year by Philippe Courtier, President and Vice-Chancellor UTC, was intended to "create a first contact between students and science, students and high-level research".

"The ongoing, drastic and unprecedented reduction of species has never seen its equivalent in the past. Less well-known to the public at large is the effect of biodiversity on the climate change".



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Beyond 'Structuralism' and 'Individualism' lies Pragmatism

Director of Studies at the Ecole des Hautes Etudes en Sciences Sociales (Paris) where he heads the Pragmatic and Reflective Sociology Group, Francis Chateauraynaud gave the second inaugural lecture at the UTC on September 4, 2019.



FRANCIS CHATEAURAYNAUD

So, why make a plea in favour of pragmatism? "This school of philosophy, which arose in 19th century in the USA, critically addresses the stance of rationalist authorities, based on a distant and formal conception of the conditions of access to reality. Rationalism rejects historical contextualization and, above all, does not do justice to the actors' experiences," he explains. Rationalism has left its mark on sociology.

Cette discipline a été dominée jusque dans les années 1990 en France par deux courants de pensée, l'un holiste et structuraliste, l'autre fondé sur la rationalité économique individuelle. « C'est vers la fin des années 1980 que plusieurs sociologues français – comme Bruno Latour, Luc Boltanski ou Louis Quéré –, se sentant pris en étau par les approches dominantes des sciences sociales, ont déporté le travail sociologique sur des phénomènes qui n'étaient pas pris au sérieux, comme les disputes

ordinaires ou les controverses publiques », affirme-t-il. Étudiant à l'époque, Francis Chateauraynaud va accompagner cette rupture épistémologique en la prolongeant dans ses travaux.

Les caractéristiques d'une sociologie pragmatique à ses yeux ? « En premier lieu, ne pas prendre les gens pour des imbéciles et considérer que, dans leur micro-monde, ils ont des capacités et des formes de réflexivité, grâce auxquelles ils surmontent bien des épreuves. En deuxième lieu, contre tout déterminisme, le pragmatisme assume l'imprévisibilité des conduites, en examinant les façons de créer des futurs possibles, même en situation extrême. En troisième lieu, il s'agit d'observer les choses en train de se faire, en mouvement plutôt que refroidies à travers des variables, comme dans les questionnaires. Avoir en somme une approche plus ethnographique. Enfin, être pragmatique, c'est considérer que le sens

dépend fortement du contexte », détaille-t-il.

Loin de l'hyperspécialisation, Francis Chateauraynaud s'autorise à « opérer des déplacements continus par rapport aux objets de recherche les plus institués ». Il admet apprécier les bifurcations. Ainsi, après avoir initié une sociologie de la preuve, il s'est déplacé vers les alertes en santé publique, puis les questions d'environnement et de choix technologiques, en suivant des controverses autour du nucléaire, des OGM, des nanotechnologies, des gaz de schiste, etc.

Son intervention ? « Comment tirer les leçons de toutes ces controverses ? Que nous apprennent-elles sur le monde dans lequel nous vivons ? Au-delà des disputes, comment relier la nécessité de savoirs stabilisés et l'ouverture à la pluralité des expériences du monde, à la diversité des façons de vivre ? » conclut-il. ■ MSD



ANNE-VIRGINIE SALSAC

Opening New Pathways to Medical Innovation

Anne-Virginie Salsac is a research director at the CNRS and works at the Biomechanics and Bioengineering Laboratory (BMBI) at the UTC. A specialist in fluid biomechanics, CNRS bronze medallist in 2015, she is curious about everything and is committed to the task of passing on her knowledge. On September 6, she delivered the third inaugural lesson.

What is curiosity? "I've always been curious about the world and I've always loved meetings, exchanges and discoveries. History, culture(s), lifestyles, languages and, of course, science in the broadest sense and technology: everything interests me," she explains. And it was this curiosity that led her, after science 'prep' classes, to choose fluid mechanics, an area she had not tackled before.

"A taste for transmission? "I inherited it from my mother, an English language teacher, who had an exceptional pedagogy and openness to the world. I've always had this taste for teaching, because it's a way opening out to others, a framework for exchange from which we grow mutually," she adds.

She discovered the world of research at the

University of California San Diego (UCSD) in her final year of engineering studies and did her PhD there, before becoming a lecturer in London. The Californian experience proved decisive, since it was there that she discovered fluid mechanics related to the human body. A new passion was born.

So, why choose UTC in 2007? "After working on the exploration of blood flow in large vessels, coming to work at UTC provide an opportunity to explore other levels and scales, such as microcirculation and problems related to microencapsulation. The main objective was to enable innovation in medicine," says Anne-Virginie Salsac.

In microencapsulation, for example, "the question is to be able to determine the mechanical behaviour of vectors containing active substances, and to

understand their sub-flow dynamics. This enables medicinal substances to be released into the organism in a controlled and targeted manner," she stresses.

Cutting-edge research which, thanks to projects such as the one funded by the ERC, has brought together a large number of colleagues and partners leading to transfer protocols to clinics and patents. "One international patent concerns the manufacture of microcapsules calibrated in both size and deformability using microfluidic techniques. Another concerns a minimally invasive device designed to repair heart valves. What's coming next? Three other patent claims are currently being registered!", concludes Anne-Virginie Salsac. This cycle of discoveries will not stop soon. ■ MSD

L'UTC IN THE 2019 RATING

CHARTS Ranked 4th French university in the "International Reach" category and 13th French university in the "Industrial Revenues" category by Times Higher Education supplement (TES). UTC came in at 7th place in the "L'étudiant.fr" ranking of engineering schools on social networks. ■



A NEW ERASMUS MUNDUS EPOG+ MASTER'S DEGREE



In September 2020, the UTC will offer an Erasmus Mundus Master's degree in "Economic Policies for the Global Transition", which will become

one of the four European Master's degrees of excellence in economics. The programme (in English) includes a Master 1 abroad, semester 3 in Paris and semester 4 at one of the 40 partners and associate establishments around the world. Each year, 22 very select scholarships will be awarded (1 000 €/month + installation and/or travel expenses). More at: www.epog.eu ■

1st MEETING OF THE 7 TERRITORIAL THEMATIC AGGREGATES

Nearly 150 participants were present at the first meeting of the UTC "aggregates". This was an opportunity to bring together industrial partners, lecturer-research scientists and students to discuss the 7 territorialized thematic clusters, which are part of the Oise Metropolitan Cluster: naturalness, resilience, industry of the future, health, aeronautics, energy and bioresources and water. ■



A CONVENTION SIGNED WITH THE UNIVERSITY OF SARAJEVO

In September 2019, UTC authorities signed an agreement entitled "Agreement of academic cooperation" with the University of Sarajevo, Bosnia-Herzegovina, to promote cooperation between the two institutions through activities such as networking and exchange of teachers, students and other staff for events of mutual interest; joint participation and application for funds for education, research and artistic activities; joint training and research activities; joint organization of conferences, symposia, congresses, seminars and summer courses. ■

THE GEC AT THE HEART OF THE INTERNATIONAL MEETING OF LIPIDOMISTS



In October 2019, the GEC team organized the 15th international meeting of the Groupe d'étude et de recherche en lipidomique (GERLI Lipidomic Research), as well as the Journées des Lipidomystes [Lipidomists' Open Day]. These two events were attended by 250 participants. Chaired by Vincent Rioux, the GERLI event brought together university professors from Singapore (Markus R. Wenk), Monash in Australia (Ben J. Boyd), Southampton (Philip Calder), Director of Research at INRA, at the Carmen laboratory in Lyon (Dr Marie-Caroline Michalski) to present their results. It provided the opportunity to award prizes to the best theses in this field. For more than 20 years, the laboratory has been working on lipid species and their properties, particularly in terms of fatty acids, for industrialists such as Total, or on the nutritional aspect of these fatty acids (omega 3 and 6) for agro-food groups such as Lesueur. ■ **PS**

HEALTH

Smart Health also plays out at UTC

Dan Istrate a lecturer-cum-research scientist at the UTC Biomechanics and Bioengineering Laboratory (BMBI UMR 7338), and his team, work on connected biomedical objects. This is a research area at the cutting edge of innovation in the field of e-health, potentially leading to scientific innovations and major societal transformations.

Dan Istrate, with the Chair for "Connected biomedical tools in Remote Medicine" called e-BioMed for short, is developing innovative connected tools, mainly devoted to medical care for patients at home.

His work targets several themes such as the prevention of premature births, remote medical monitoring of chronic diseases and related 'polyopathologies': in particular, cardiovascular diseases and the consequences of CVA strokes, but also the remote medical monitoring of elderly persons to encourage them to stay at home and to improve and personalize their care when they have to live in specialized health establishments. The UTC-BMBI laboratory studies the human body as a whole, its molecular system, blood circulation, etc. "More specifically; we analyse movements, how the bones 'work', the biomechanics of the human body. We monitor patients. For cardiovascular cases, we have monitored sixty people, the data from whom we recorded for a month in order to detect sources of stress and emotions," explains Dan Istrate, who, together with muscle specialist Sofiane Boudaoud, analyses the influence of stress on our lives.



DAN ISTRATE

application automatically compares them to the movements he or she should make, based on a model of the functioning of the neuro-musculo-skeletal system developed by BMBI biomechanics experts and engineers. As a result, it can guide patients with a built-in autocorrective process. Another innovation currently studied is a device to remotely monitor swallowing disorders following a stroke; the process involves sound processing. "We have designed and developed a microphone system positioned at a person's neck that allows us to analyse the swallowing sounds and see if they are normal or not when the person drinks water or eats spoonfuls of apple compote."

Connectivity and out-patient surveillance

With the help of artificial intelligence (AI) via connectivity, it is also possible to collect large amounts of data, especially psychological data, for an ever easier follow-up of the patients. This gives an idea of how tomorrow's health professions will change. "It will require someone to process all this data collected at home or in an outpatient clinic. You will also need someone capable of analysing and validating this data. "For the moment, one of the major objectives of the laboratory is to improve on patients' care, enabling them to live as normally as possible and avoid hospitalization, which will also help to control health care costs. ■ **KD**



A serious game to avoid falls

Dan Istrate also invented sensor systems placed in the environment of an elderly person to remotely detect distress situations: discomfort, falls, etc. "Over and above detecting falls, we are more interested in preventing them. So we imagined and devised a game a year ago to help with rehabilitation at home. The patient can do functional re-education exercises of the lower or upper limbs at home, between two physiotherapy sessions," adds the research-scientist. This game is now one of the team's most advanced projects and is based on a completely new approach. A camera and accelerometers placed on the patient's body record the patient's movements, and the



Food innovation

at the heart of future health concerns

The Enzyme and Cellular Engineering Laboratory (GEC), a CNRS-UTC joint unit, combines fundamental and applied research around two main themes. The first, called the "green" theme, concerns everything related to plant metabolism and bioresources with concrete applications, such as the replacement of mineral oils by lipids produced by plants, or the use in nutrition and health of phytosanitary-compounds known for their antioxidant and anti-tumoral properties, such as betanine. The second, the "red" theme, aims to explore the issues of bio-mimetism and biomolecular diversity, in particular by designing biomolecule banks or creating polymers with molecular fingerprints whose recognition performance is comparable to that of antibodies. Innovative research with fields of application ranging from health, to cosmetics and agro-food.



A Woman with science and taste



CLAIRE ROSSI



Claire Rossi, UTC professor of biological engineering, is also responsible for the Innovation, Food and Agroresources elective specialty and the Food Science Platform at UTC's Daniel Thomas Innovation Centre.

She pursues research activities at the Enzyme and Cellular Engineering (GEC) Laboratory, a joint CNRS-UTC unit. "My research focuses on the food sciences and the impact of nutrition on health, or how to improve well-being through diet," she explains. Appointed lecturer at UTC in 2007, Claire Rossi began in fundamental research. "The objective was to study how compounds of interest interact with cells at the molecular level, such as active molecules from plants or pathogens, such as toxins... In a word: studying precisely the moment when molecules interact with the cell membrane barrier," she explains.

However, she had other skills - "another hat," she says - especially in food and agro-resources, which are quite far from her fundamental research, which is mainly biological.

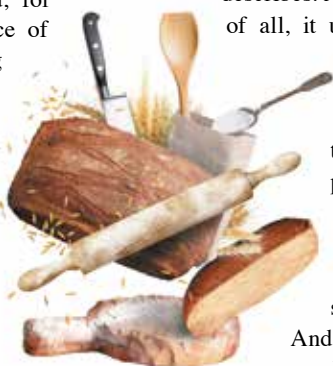
So, how can these two themes be reconciled, valorised and enhanced? "This is how the themes of the Food Science Platform emerged. The key idea? It was to use the concepts provided by the fundamental research carried out within UTC-GEC for concrete applications developed on the platform, directly aimed at the consumer, and therefore at industry, while placing training at the centre of these activities through student projects," she emphasizes.



This has led her to her current research, which focuses on preventive health care on the one hand and innovative foods on the other. "In the first case, the aim is to understand the activity of plant-derived molecules and their impact on human health, for example: the action of flax pectin in preventing vascular calcification or that of beet pigments for their antioxidant or anti-tumoral preventive properties. But the interest lies in working not only on isolated natural molecules, but to focus on their effects and their interactions within food matrices. Hence the idea of studying nutritional optimization of food. In other words, to work on very classic foods such as sauces or even sandwich bread, for example, and to rework the balance of nutrients in the food, without altering its appearance or taste, an essential point in the pleasure of eating. It is also possible to incorporate natural origin active molecules, according to the properties desired", explains Claire Rossi.

And with what concrete applications? "Take tapioca flour produced by our partner, the Cassava Starch Corporation in Tanzania. It is a natural food that makes it possible to prepare a 'Dutch' sauce that is as creamy and tasty as a classic sauce, but with a fat content that is halved. In a nutshell: working on the biochemical structure of the food without denaturing it," she says.

Involvement of students in very concrete projects?



"This gives them undeniable project skills. They can then take part in competitions such as Ecotrophelia, where the various agro-food schools compete against each other, or then create start-ups," insists Claire Rossi. With the Hush project for example, they won the Gold Trophy for their first participation in Ecotrophelia France in 2018 and the prize for the best innovation the same year at the European edition of this competition, where the winners from each country compete against each other? "Hush is a fruit-based drink with a cappuccino texture and a nutriscore A, the best score on a nutritional scale from A to E," she describes. A success that delights her. "First of all, it underscores the quality of our training. It has also reinforced my approach that innovative foods must remain - this is my trademark - very tasty and give pleasure while being better for the health of the consumer. In short, to combine conviviality, pleasure and well-being," she says.

And in terms of start-ups? "One example is Smeal, which was founded by former students, whom we supported. For several years now, it has been marketing a practical, nutritionally perfect meal, designed in particular for sportsmen and women, in the form of a rehydration powder. Hence the name 'nomadic meal'. Or its trade-name Hush, which will be created and launched next December," she concludes. ■ MSD

INNOVATION FOOD

AND AGRO-RESOURCES (IAA) A HIGHLY SOUGHT-AFTER ELECTIVE SPECIALTY

It is a small specialist section (between 20 and 25 graduates per year), but recognized in the world of agro-food innovation.

By winning the Gold Trophy at the Ecotrophelia France competition in 2018, then the Coup de Coeur prize at the Ecotrophelia Europe competition with their "Hush", fruit-based hot drink, the IAA students have demonstrated their skills. And companies are not mistaken. Indeed, between 2014 and 2017, the time it took to secure a first job was less than three months and 54% of the students were hired even before their final internship. The programme includes courses in the fields of food formulation, innovation, nutrition, analysis of organic and food products, agro-industrial operations, marketing of innovation, etc. During training, students also have access to a sensory analysis room, a food formulation laboratory and equipment for measuring the physico-chemical and rheological properties of food.

Emma Ruby, who graduated in 2017

Why did you choose this line of work?

I was attracted by the science that underscores food, it's an area that raises questions of public interest, ethics and is at the heart of current and future issues.

And what now?

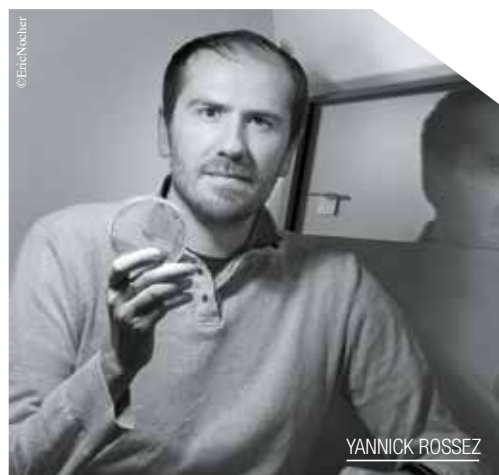
After 2 years of VIE in a bakery/pastry/chocolate ingredients company (Puratos), I was hired as Junior R&D manager in the field of bread 'improvers'. ■ MB



EMMA RUBY

Inhibiting bacterial adhesion

Yannick Rossez is a CNRS research fellow in the UTC-GEC (Enzyme and Cellular Engineering) Laboratory. His work focuses particularly on the bacterial flagellum, responsible for bacterial motility.



YANNICK ROSSEZ

His interest in this field? "It was during my post-doc in Scotland and following an epidemic in 2010/2011 that killed more than 50 people that I became interested in pathogenic host bacteria, which are mainly associated with food poisoning," he says. From then on, Yannick Rossez's objective was "to understand whether pathogens, known in the scientific community to specifically recognize human tissues, had developed strategies to resist in an intermediate host. Namely fruits and vegetables eaten raw". He is interested, in particular, in 'adhesins' - the molecules responsible for adhesion - carried by bacteria and the strategy they develop to recognize structures carried only by plants. But one particular adhesin, the bacterial flagellum, is

of particular interest to him.

"Known until now as responsible for bacterial motility - displacement of the bacterium - I discovered that it was able to adhere to human tissues via lipids on the cell surface. Without adhesion there is no bacterial pathology," he says. Admitted to UTC in 2016, he continued his work naturally on the flagellum - "a major project", he says - a subject that has a strong impact on the food industry by studying the interaction between lipids and bacterial flagellum in adhesion. He is developing biomimetic membranes, prof. Claire Rossi, in order to understand the mechanisms that make one lipid more favourable to adhesion than another. The result is a discovery that will be published soon:





"The more we eat a diet that is rich in polyunsaturated fatty acids, better known as Omega 3s, the less risk we run of being colonized by bacteria", announces Yannick Rossez.

So, what is our current strategy? "It's a question of inhibiting the adhesion process as early as possible, preventing colonisation and therefore the appearance of bacterial pathology and, ultimately, not only reducing the use of antibiotics, but also antibiotic resistance," he explains. Another field of research? "I'm interested in 'mechanosensing', a very recent and expanding discipline. Here again, the aim is to inhibit the ability of bacteria to detect surfaces and thereby prevent bacterial adhesion," he concludes. ■ MSD

PORTRAIT !

As a PhD student at the UTC-GEC laboratory, H     Cazzola is preparing a thesis entitled "Impact of cell membrane lipid composition on bacterial adhesion via the flagellum", directed by Claire Rossi and Yannick Rossez, which she defended in October 2019.

During her last year as a chemical engineer at ESCOM, H     Cazzola also began a Master's degree in biotechnology at UTC. The reason for this choice? "I like scientific multidisciplinary, especially the interface between chemistry and biology," she explains. And it was during her end-of-year internship at the UTC-GEC that she



H     CAZZOLA

discovered the world of research.

"With Claire Rossi, my intern supervisor, I discovered the world of research and appreciated the opportunity to work on fundamental subjects that could be useful for future applications," she emphasizes. It was with this in mind that she chose her thesis topic on "the adhesion of pathogenic bacteria", she says. "Adhesion is a strategic step in the fight against the persistence of pathogens, the first step before colonization and infection of the host," says H     Cazzola. ■ MSD



Encapsulating betanine



AUDE CORDIN

Aude Cordin, lecturer at the UTC since 2006, is also a research scientist at the UTC-GEC (Enzyme and Cellular Engineering) Laboratory. She works in particular on the encapsulation of pigments extracted from beetroot, a project financed in particular by the French Hauts-de-France Region.

focused on materials", she adds. This led her, as soon as she arrived at the UTC, to work "on polymers with molecular imprints. In other words, polymers capable of recognizing a target molecule, and then on the design of degradable materials allowing the controlled release of active principle". Hence the project to encapsulate betanine molecules. "The idea is to encapsulate them with a protective membrane to prevent degradation and thus improve their shelf life," she adds. The challenges ahead? "The first is to be able to manufacture capsules - from 5 to 10 μm - that are compatible with food applications. This limits us both in the type of materials that could be used and in the choice of manufacturing process. The second is to have a capsule that will be able to protect molecules throughout the digestive tract and release them into the intestine. Where it will be assimilated by the body," she says. "The capsule must not open in the stomach, but only once it has reached the intestine," insists Aude Cordin.

The aim of this project? "The aim of this project is to enrich a food product with antioxidants. A product which would thus have a preventive role for health. In this case, we are talking about health foods", she explains. A project that is in an experimental phase with, already, tests on a first encapsulation method. "We were able to show that it is possible to encapsulate betanine and that this encapsulation improves the conservation of the substance over time. Other encapsulation systems are being studied for the controlled release of pigments in the intestine", concludes Aude Cordin. This betanine encapsulation project, financed in particular by the Hauts de France Region

and the European Regional Development Fund (ERDF), involves several laboratories: on the one hand, the UTC-BMBI and the UTC-TIMR, and on the other hand the UniLaSalle institute in Beauvais. ■ MSD

What's your area of research? "In collaboration with Claire Rossi, I am working on the encapsulation of natural products that may be of interest to the agro-food industry. We are interested in pigments extracted from beetroot, or betanine, with promising antioxidant and anti-tumoral properties. However, these compounds are very sensitive to their environment - light, temperature, pH, etc. - and are therefore very sensitive to their environment. So they can be broken down even before they are assimilated by the body," she explains.

A field that is nurtured by her interdisciplinary background. With a degree in chemistry, she decided to present and defend a thesis on "the valorisation of natural substances. It was about modifying them by biocatalysis in order to introduce new interesting properties for cosmetic applications", then a post-doc "more



PORTRAIT !

Nesrine Ben Hadi Youssef is a PhD student at the UTC-GEC (Enzyme and Cellular Engineering) Laboratory. She is expected to defend her thesis, supervised by Claire Rossi, Anne-Virginie Salsac and Aude Cordin, in January 2020.



NESHINE BEN HADI YOUSSEF

During her studies as an agro-food engineer at Agro-Sup Dijon, she did a research internship at the University of Minnesota (USA) on flavour encapsulation.

"I discovered and appreciated the world of research there," she says. This taste for research led her to do her final year internship at Adrianor (Arras), a technological resource centre at the interface between research and the food industry. "I carried out research there on the formulation of gluten-free bread," she explains.

It is therefore without hesitation that she is presenting her thesis on the "Microencapsulation of antioxidant molecules for the enrichment of food products" a subject proposed by the GEC Lab. In this context, Nesrine Ben Hadi Youssef is particularly interested in betanines, a class of antioxidants found in beet. ■ MSD



UTC as a major partner

Professor at Cranfield University (Great Britain), Fady Mohareb is in charge of the bioinformatics team in the laboratory dedicated to the food industry. Between 2010 and 2018, he was also Manager of the European Partnership Programme, a double degree curriculum set up by Cranfield University. He details the nature of the relationship between the two institutions.

When did the academic and/or research relationship between Cranfield University and UTC begin?

The relationship between our two institutions goes back more than a decade, when the two universities signed a protocol for the exchange of students following a dual curriculum within the framework of the "European Partnership Programme" (EPP) set up by Cranfield University. Since then, UTC has been considered a major and strategic partner for Cranfield University.

In what areas have they developed?

They concern the food industry, biotechnology and bio-computing, automotive, aerospace and industrial production.

With regard to your own areas of expertise, what research is being or has been carried out in cooperation with UTC? With which laboratories?

As a specialist in applied bioinformatics, more particularly in machine learning, I have collaborated mainly with Professor Claire Rossi from UTC-GEC (Enzyme and Cellular Engineering) Laboratory (a UTC/CNRS mixed unit), with Benjamin Quost from UTC-Heudiasyc (Heuristics and Diagnostics of Complex Systems) Laboratory and with Claude-Olivier Sarde from UTC-TIMR (Integrated Transformations of Renewable Matter) Laboratory of the UTC in the fields of agro-food and bio-computing.

Can you specify and give concrete examples of collaboration?

It all started with the "European Partnership Agreement (EPP)" established by Cranfield University. A double degree curriculum that allowed high-potential students from UTC to join a MSc programme at our university after their third year. With one advantage: exemption from registration fees. Today, we have decided to go one step further with the EPP. This second phase concerns PhD students from both institutions who could, for their research, work either at Cranfield University or at UTC.

Another, more recent example of this collaboration?

A seminar entitled "Seed Meeting" held at the French Embassy in London in October 2018. Funded by the Department of Higher Education, Research and Innovation of the French Embassy in London, it was co-hosted by Claire Rossi and myself. The aim of this seminar? It notably served to identify potential synergies between our two teams in terms of research and innovation and to enhance research collaboration between our two universities.



FADY MOHAREB

This meeting was very fruitful since we have already identified a possible research partnership in the field of bioactive molecules from plants. Our two



Based in Tanzania, Cassava Starch Corporation is an industrial partner of UTC's Enzyme and Cell Engineering (ECG) laboratory.

Their project? To build a factory to produce tapioca flour. "They have a rather virtuous approach, since they control their entire cassava crop. They can select roots with different growth times. Which is very interesting from a functional point of view. Finally, they can produce organically. This is quite rare for these flours," says Claire Rossi. What is the GEC's mission in this industrial contract? "It's a question of studying the potential of this flour and exploring the whole range of substitution applications that it could allow in the future and looking in particular for the highest possible added value applications", explains Claire Rossi. An ongoing high added value application? The manufacture, for example, of a loaf of bread that turns out to be softer and has a better shelf-life than a classic loaf of bread without added fat. In short, a tasty bread good for your health. ■

MSD

PORTRAIT !

Megan Eoche-Duval graduated from UTC in 2017, majoring in Bio-Engineering, and specializing in Innovation, Food and Agro-resources (IAA). She also holds a Master's degree in Nutrition, from University Paris 6 (Pierre and Marie Curie). She has worked with the Danone Group since 2018.

What motivated the choice of UTC? "During my MPC (math, physics & chemistry) preparation, I realized that I missed biology a lot. But at UTC, not having done biology before didn't seem to be a problem, even

though I had to work hard to catch up in the subject," she explains.

Another, older motivation? "When my brother was in his final high school class, we went to the UTC Open Day". What did he like? "The fact that you can choose a personalised à la carte training course, have teachers who listen, work on projects - a good preparation for integration into a company - and finally that it offers activities such as drama or music classes, and is on a human scale," she emphasizes. Megan Eoche-Duval was recruited by Danone at the end of her master's internship as a member of the "Innovation Aquadrinks" team. ■ MSD

teams are currently trying to identify the most suitable calls for projects, both on a bilateral and international level, in order to officially conclude an agreement in the field of research between our two institutions.

Will there be closer links between researchers in the future?

Absolutely, since over the years to come, researchers will be invited to spend half their time in Compiègne and the other half in Cranfield. ■ MSD



GEC Lab

reporting to UTC, the CNRS and University of Picardie

Professor of Biochemistry at UTC, Karsten Haupt has been Director of the Enzyme and Cell Engineering (GEC) laboratory since 2012, reporting to the CNRS Institutes of Biological Sciences and Chemistry, plus the UTC and the University of Picardie Jules Verne (UPJV), Amiens

A word about the GEC team?

GEC is a smallish UTC research unit, comprising about thirty tenured staff - 20 lecturer-cum-research scientists and technical staff, engineers and lab technicians. However, depending on a given year and on the projects and funding available, there are between 60-70 personnel, including PhD and post-doc students.

What are the GEC's major research areas?

The unit has recently been restructured around two main themes. All of the unit's projects fit into one of the two themes, with a constant concern to provide answers to technological challenges, societal issues and scientific questions. The first, called the "green" theme, concerns everything related to plant metabolism and bioresources. Among the objectives is to have plants produce unusual molecules or produce them in small quantities. One of our goals is to avail of plants

producing lipids that would eventually replace mineral oils. Hence our involvement in PIVERT, an Institute for Energy Transition (ITE) including industrialists, selected to benefit, as of 2011, under the Government incentive programme "Investments for the Future. We are also interested in polyphenols, which have properties that could be of interest for the agro-food industry, and we are carrying out more cross-disciplinary projects such as studying the interaction of plants with their environment - how to protect them from stress, from the action of micro-organisms or, for example, how to optimise the use of ligno-cellulosic residues once the oils have been extracted.

The second, the "red" theme, focussing on the issues of bio-mimetics and biomolecular diversity, with two complementary approaches. In the first case, our objective is to design biomolecule libraries containing antibody fragments, peptides or nucleic acids. Currently, we have libraries

containing more than one billion molecules from which we are able to select bio-compounds of interest, capable of interacting with an identified target to neutralize or detect it. In the second case, we are interested in the development of materials dedicated to molecular recognition using a "tailor-made" approach. In other words, to create polymers with molecular prints with recognition performance levels on a par with that of antibodies. Here again, the fields of application range from health to agro-food, but can also be integrated into more fundamental studies. We have more and more cross-disciplinary projects, which is an indicator of the coherence of our themes. We are also relying increasingly on rationally designed tools.

Can you cite some practical applications?

We have many applications, so let me just mention a few. In the food sector, for example, we will use sensor-equipped polymers to detect problematic molecules in real time, such as the presence of anabolic agents, antibiotics and endocrine disruptors, pesticides in excess of thresholds or even diseases such as cystitis in cows. In the health field, the aim is to produce antibodies that can be used in immunotherapy. This field seems to be of particular interest to the pharmaceutical company Sanofi, with whom we have already worked as part of a European project.

In your opinion, what are the strong points of GEC?

In terms of international visibility and recognition, I would cite, among other things, metabolic engineering of oilseed plants, our expertise in molecularly imprinted polymers and our know-how in banking and breeding. ■ **MSD**



HUSH, AN INNOVATIVE FRUIT DRINK

HUSH (Heat-Up Shake Health) is an innovative fruit-based hot drink that is part of a balanced diet suitable for vegans and lactose-intolerant people. It was developed by Justine Patin, Baptiste Pontreau, Camille Paul, Aurane Lherbier, Mélanie Abherve-Gueguen and Cornélia Garaudel, all graduates of the UTC elective specialty (IAA) Innovation in Food and Agro-resources.

Justine Patin explains: "Thanks to the equipment made available to us at the Food Science platform and the expertise of Prof. Rossi, we came up with an ideal product one that met all the specifications. At the same time, the marketing assistance provided by Ms. Darène convinced us of the relevance and innovative nature of our product. This adventure allowed us to work on the creation of an innovative food product through a multidisciplinary approach: from a market study, progress from innovation to our business plan, through formulation, technology-intensive studies, quality and production management and various regulatory requirements". HUSH won the gold medal at the national level and the "Coup de coeur innovation" award at the European level of the Ecotrophelia 2018 food innovation competition. ■ **MB**





BACK TO UTC

A well-managed start to the new academic year

Etienne Arnoult, Director of Training and Pedagogy and Antoine Jouglet, Head of Engineering Training and the UTC Core Programme, together with their teams, ensure the smooth running of UTC. Sixty people work on a daily basis to ensure the best possible start for the students, but their mission does not stop there.



"Course make-up flexibility at UTC makes its originality and which is more and more challenging. Our system is more relevant than ever and capable of adapting both to the needs of its students - whose profiles are so different (half of our graduates are recruited post-bac, but the other half come from IUTs, BTS, Bachelor's degrees, preparatory classes for the 'grandes écoles'*, etc.) and to the changes in the industrial world in which our graduates are inserted. In order to adapt tomorrow to the changes that are shaking up the French high school system, for example, we are already able to propose solutions that will preserve the individualization of the courses and the quality of the diploma, while accepting, post-baccalaureate, profiles made increasingly diversified by the reform," continues Etienne Arnoult, reaffirming that the UTC will respond to the concerns of high school students and their parents on this very sensitive issue of transition to higher education. The calculation of the timetable is a formidable tool in the face of the reform. It is in fact thanks to the system of "à la carte" courses that students will find the means to prepare

The 2019-2020 academic year was organized, as every year, by the Directorate for Training and Pedagogy.

No less than seven departments are involved, including Admissions, Study Administration and Teaching Resources, not forgetting the assistance of all the pedagogy managers (engineering training, including the Common Core, Hutech, Master's and professional bachelor's degrees). At the beginning of this academic year, 389 students were accepted in the Common Core Programme (including Hutech), 470 in the branch (including apprentices), 150 in the Masters' programmes and 27 in the Vocational Degree studies programme. "A new academic year is prepared almost a year in advance, starting with participation in the various trade fairs organized throughout France from October onwards. We need to define our strategy, choose the fairs and forums where we will be present and prepare the speakers who will be on

duty (colleagues, but also students), in particular to know how best to respond to the future candidates they will meet," explains Etienne Arnoult, who has been Director of Training and Pedagogy since 2016. Before welcoming these 389 students, nearly 9 000 applications had to be studied before organising the formal admission juries, during which some 4 000 applications were reviewed, 1 500 finally selected, and in practice, only 800 were called up via the HE Parcoursup selection/orientation data base.

Originality: tailor-made curricula

Ever since it was established in 1972, the UTC has endeavoured to be and stay at the forefront of pedagogical innovation in order to maintain its unique character. UTC is an original establishment in the French higher education landscape, with both engineering school* and university status. Thus the best of both worlds is brought together for students who can build-up and plan for their careers here according to their intellectual affinities and professional projects. Students are free to make their choice of CCs.

KEY FIGURES

At start of this academic year 2019-2020, UTC has matriculated

- 389** undergraduates to the Core Programme (covering both humanities and technologies)
- 470** branch sector students (including student apprentices)
- 150** registered for a Master's Degree
- 27** registered for a Vocational Degree



855
non-French nationals
matriculated at UTC
(including Erasmus
exchange scheme and
PhD students)

themselves as best as possible for their training course, by choosing their courses according to their background. But for this to happen, the UTC must be able to design individualised timetables, a challenge that is renewed each semester by the teams in the teaching resources department. Building the timetable at UTC is therefore a real challenge. A research unit is even working on this subject. "I have lots of admiration for the people who work on it. We must have nearly 3 000 students in the walls, so there must be 3 000 schedules to calculate at the start of the school year. And every schedule has to satisfy everybody, both our students and the 450 teaching staff. It takes a lot of goodwill. The software has to take into account an impressive number of parameters and constraints," he points out.

Ensuring overall cohesion

Etienne Arnoult works closely with Antoine Jouglet, lecturer-cum-research scientist, who is in charge of engineering training and the core curriculum. Both colleagues communicate very frequently with all the teaching managers of the various courses. Enough to put oil the wheels, one



might say. "My job is to ensure that each student succeeds in his or her training project. This involves coordination, of course, but also arbitration and advice. What also motivates me most is the satisfaction of helping students with their personal situations and helping to find solutions to their problems," confides Antoine Jouglet. "Some of

them have the feeling at times that they are taking a big leap into the unknown and playing dice with their lives by choosing this or that course of study. This is a great source of stress for them. I'm also here to calm things down. » ■ KD

* A member of the famous French Grandes Ecoles system (engineering mostly)

TRAINING THE ELITE

Various excellence courses at UTC



"There really is a life after school!" This maxim of the UTC students takes on a special meaning for sports students, musicians or entrepreneurs. In order to accompany them in the best possible way, UTC has set up three courses allowing them to follow the classes while investing in their parallel, personalised projects.

Elite sports

Top-level athletes are pampered at the UTC: individualised pedagogical supervision, curriculum development, access to the movement analysis platform, etc. Everything is done so that they can follow their studies serenely, without giving up intense practice of their sport or competition. This is the case of Tom Laperche, a mechanical engineering student, who has been able to combine his studies with his passion for sailing: "Studying engineering was logical for me and sailing is an increasingly technical sport, scientifically understanding the behaviour of structures and materials is a real asset in competition as well as providing a real thrill."

Elite Musicians

Musicians do not have to give up their instruments when entering UTC. On the contrary, specific CCs in collective instrumental practice are even open to them. And, for students with a level rated as "excellent", they can benefit from a

one-year training course in partnership with the Conservatoire de Compiègne, including private lessons for their instrumental practice, workshops...

Entrepreneurial Elite

In addition to course planning and personalized follow-up by an entrepreneurial studies coach, students who join this program can spend their final internship period in their start-up. They can also benefit from the facilities of the UTC Daniel Thomas innovation centre (FabLab, creativity room ...), as well as help in finding financing (CRP, BPI, Pépité...), etc. This course has been a great success since its creation, as confirmed by Edgar Jullien, co-founder and CEO of the HEPIC application, currently in the management of innovative projects in mechanical engineering: "The UTC supported us by integrating us into entrepreneurial elite course, which allowed us to be followed by professionals and to benefit from a development of our course, allowing us to set aside time devoted to our project." ■ MB



GOING AWAY ONE DAY



KEZIAH COYO IS ONE OF UTC'S RECENT GRADUATES. AFTER 3 YEARS OF STUDIES IN HUMANITIES AND TECHNOLOGY AND 2 YEARS IN URBAN ENGINEERING, SHE RECALLS SOME OF HER INTERNATIONAL EXPERIENCE
Where did you go?

I went to study in Berlin and more precisely at the Technische Universität in Berlin (TUB), in the framework of an Erasmus exchange. At that time, I was starting my third year in an engineering school, namely UTC.

Why did you choose this destination?

I chose Berlin because I wanted to improve my German language proficiency. After almost 7 years of academic lessons, my level had not improved much. My objective: to be able to speak fluent German.

Did you feel any progress during your stay?

Yes, every week I could see how much progress I was making and it was amazing.

What is your best memory during your Erasmus stay?

My best memory of Erasmus?... there are so many, it's hard to choose! I would say meeting my boyfriend, a Berliner with whom I experienced a very beautiful, multicultural and challenging personal story.

What did you learn on the spot?

Well I learned ... I learned to speak German fluently and this was important for me at the beginning. However, in retrospect what mattered most was what I learned about myself. This Erasmus exchange stay has played an important role in building myself, my world vision, my priorities.

Did this exchange make you want to leave again?

Yes indeed. It has clearly made me want to continue travelling round the world to meet with other cultures. But also to extend my stay: instead of 6 months, I finally stayed for a year in Germany and when I came back to France, I had only one desire... to go back!

Where to?

I applied to go to Canada, which allowed me to do a full semester in Montreal at the Ecole de technologie supérieure (ETS), for my last year of my engineering studies.

What did you prefer, Germany or Canada?

I can't really compare what I experienced in Canada and Montreal. It's far too different. But I did find my immersion greater in Germany. In fact, making the effort to learn another language and lodging only with locals allowed me to integrate very quickly. In Montreal, a real immersion was more difficult to achieve, especially since the French language is similar there and above all there are many French people there! On the other hand, what I retained was a special relationship with nature, and Canada's breath-taking landscapes.

And would you like to work professionally abroad in the future?

Yes, working abroad, why not? It is an opportunity that I would seize with enthusiasm if it presented itself to me, but it's not something I'm particularly looking for. Because with these stays, I've realized what I like here in France and if it's not homesickness as such, call it maybe "acute cheese starvation" or the "baguette de pain syndrome" that will catch up with you at some point during your stay abroad.

As a recent and young graduate, have you a quick word to share with the students?

Sure! Go for it! Going abroad is really a great experience! ■ **GO**



IMMERSION

As a festival-goer at the Imaginarium Festival (IF)

Every year – and that's six years now – we witness the same tradition: a great many French and international music scene aficionados meets on the heights of Margny-lès-Compiègne for two days of festivities. Concerts, beer and frantic dancing till dawn breaks: tens of thousands of festival-goers enjoy this two day-break before the end of the semester and the start of their exams. For Interactions, we sneaked into the heart of this festival, among the tens of thousands of spectators from all over France.



To get to the Imaginarium Festival (IF) from the train station, festival-goers have two options. The first one: to walk the 4 kilometers that separate the rail-station of Compiègne du Tigre, the large auditorium where the festival takes place. The GPS indicates 45 minutes. The courageous, like Camille from Versailles, who tried their luck speak rather of "a good hour of intense walking under a hot, hot June sun". The second option to get to the festival, much less daring, is to get on one of the shuttle buses chartered by the festival organization. On board, the atmosphere is good-natured. Some have come in disguise (as lobsters, with wigs of all colours and bold make-up), others, who are planning to settle in at the campsite, have brought with them everything they need to spend two days in Compiègne. "Pullovers if it's very cold, shorts if it's sunny and above all my flowered shirt", adds one of the festival-goers who seems to be carrying the world on his back. After about ten minutes in a bus, they finally arrived is at the Tiger.

Originally, this large area comprising hangars and

For two days, the music resounds in all the heights of Compiègne. That of Vendredi sur Mer, the star guest group of the festival. But also Caravane Palace and Suzane, a young French artist ...

fields covering several hectares designed to shelter military aircraft. But the project fell through. So the municipality developed this project of a theatre open to the outside which hosts several hundred shows and events each year. The Imaginarium Festival is one of the highlights of the annual programming of the hall. "In the queue, we make a quick check on what we're going to have to throw away. The house instructions are very strict," comments Romain, a 21-year-old Parisian student festival-goer. Alcohol



is strictly forbidden. I understand them, they want to avoid unmanageable situations. "You have to be patient to get through the security checks". So when a little drizzle starts to fall, the festival-goers present give voice and sing a few songs from Vendredi sur Mer, the star artist of this festival.

At the Festival door entrance, dozens of volunteers - most of them UTC students - are on hand to greet the attendees. "The organization of the IF is totally managed by the students," explains Nacim Bensakhria, the festival's communication manager. "We call on a few service providers for logistical and technical questions, but we manage everything else from A to Z." Throughout the year, the 'fine' student team meets regularly to manage all the details of their association. Their objective? To keep the unexpected to a minimum on D-Day. Like this Saturday, when heavy rain fell on the festival, causing a massive influx of visitors under the big tent that hosted one of the stages. For two days, music resounds in all the heights of Compiègne. That of Vendredi sur Mer, therefore, the star group of the festival. But also Caravane Palace, whose sounds project festival-goers into the summer's 'guinguettes' and Suzane, a young French artist who was to live there one of her biggest stages. But, as Manon, a native of Sucy-en-Brie, confides,

the major point of such a festival is the whole ecosystem that is built around it. "As the concerts go on, you lose your friends, you find them later in front of another stage, you meet people you know, you take a short break to go to a food truck, it's really a festive weekend."

In the middle of all the festival-goers, a small group of friends does not go unnoticed with their red jumpsuits. It's the Panache band, selected during a musical springboard to play on one of the big stages of the festival. "Originally, we are all students from Paris. Some at Ecole Polytechnique, others at University," says Amy, the group's singer. "We were lucky enough to be selected to play here and it's one of the biggest stages we've ever done."

As the sun sets and temperatures dropped, the festival quickly turns into an "electro" scene. This time the star is Møme, a 30-year-old DJ who gets the crowd going. "Honestly, I came almost exclusively for him today, I'm really proud that we can bring artists of such stature," says Corentin, a student at UTC, with a touch of emotion.

At dawn, the last festival-goers join a shuttle to go home or take refuge in the back of their tents



t o
seek a little
warmth and some
sleep before a
musical awakening ...

On Sunday, the same scenes repeat themselves, again and again. The sweet madness of summer was on its way, artists followed one another onto stage, in a parade of vocals and sequin-costumes.

The next day, the teams were already hard at work, dismantling and cleaning the place, back to in order. The leitmotiv - don't leave any traces before taming "Le Tigre" again in a year's time for a new edition of the festival ... ■ GO



MY SECOND YEAR AT UTC – EPISODE 4

"I've become an Integrator for our new students!"

We met up with our student Pierre Gibertini as he returned to UTC, this time for his second year. We had left him just before the summer holidays, a shade anxious about his exam results. So how was the end of his academic year? Was he able to enjoy his holidays calmly? And what has his daily life been like since the beginning of the school year? Pierre testifies for the Interactions readers.

Well, that's it! It's time for me to begin my second year at UTC. In the last semester, I validated almost all the courses I had taken, so it was fairly success. Our final exams, I must admit, were quite intense; with the heat wave, the exam slots were shifted to early in the morning and late in the evening. It was a real marathon race!

Once the exams were over, I made the best of the holiday break. I first went with a friend to Barcelona, to a youth hostel. It was really a very enriching experience; I met people of all nationalities, from other cultures, other ways of living. After that, I went to Italy for a few days, mainly in the North-West. I had the opportunity to visit Pisa and Florence, in particular. Finally, I spent about ten days in Montreal. Between camping on the lakeside, visiting big cities and lodging in a Natural Reserve, it really enjoyed a nice break. Suffice it to say that I was a bit sad to come back

to Compiègne... But I have some very pleasant memories running round in my head.

This year, I crossed to the other side of "the looking glass"; from being an integrating student, I became a student integrator. It's really very funny, we meet a lot of new people, our goal is that they all feel totally at ease in Compiègne and at UTC. I also took part in the organization of a big 'integration' event: the colour race. Concretely, it's a 5 km race in the city with stands where students throw coloured powders at each other. It's a bit inspired by

"We meet a lot of new people, our goal is that they all feel totally at ease in Compiègne and at UTC"

what we can see in India, for example. It's intense to organize, but it's hyper instructive.

After integration, I went back to my classes for a semester. I alternate between class courses that are computer-oriented and courses in mechanics. It's a nice balance. I also took a course in human sciences which questions the relationship between man and machine, and which pushes us to design a computer system, it's really exciting.

Among my future projects, I would very much like to go abroad... I applied last semester, but unfortunately I didn't get approved for any destination. Too bad, it will be OKed next time maybe. And I would also like to join the organization of the Imaginarium Festival. I was bluffed by what they did last year and I would like to participate in this project, on my small scale... ■ GO



UTC'S 2019 GRADUATION CEREMONY

Jean-Louis Chaussade, a confident Godfather

Jean-Louis Chaussade, , CEO of the Suez Group and of Chairman of the Board of UTC, was the Godfather of the 2019 Graduation ceremony which took place on Saturday November 23 at Le Tigre in Margny-lès-Compiègne. Interactions met him!



fact, graduating from a school like UTC is itself a source of such pride. We have schools and education in France that are of very high quality and have strongly rooted humanist values. UTC enjoys an excellent reputation, especially internationally. It is both an engineering school and a university that offers theoretical and practical courses. It's the best of its kind! It's a pity that this model is not more widespread. In fact, UTC is still pioneering in these fields. If I had to go back in time and choose a field of study, at UTC I would choose bioengineering. We haven't quite figured out everything there is to know about life. The technology, chemistry, physics and artificial intelligence associated with biology will allow us to better understand our future. At the Suez Group, we are preparing for that. Waste will soon become a resource in its own right. We aim to produce 'secondary' raw materials that are reusable, renewable. The famous French chemist Lavoisier's analysis "Nothing is lost, everything is transformed" could never be truer than it is today. ■ KD

Can you tell us our readers why you agreed to be the Godfather of the 2019 class of UTC?

When Philippe Courtier, your President, offered me to be Godfather for this graduation ceremony, I immediately responded "yes", because I wanted to say out loud and clear that when you enter an excellent engineering school like UTC and if work hard, you will succeed. I am one of those who remain convinced that with hard work, talent and self-sacrifice, you can achieve almost anything. Studying is always a launch-pad for greater things. The Suez Group has 90 000 staff worldwide, including 30 000 in France, some of whom are from the UTC, and we all work in the same direction: to provide solutions for increasingly optimized water supplies and waste management. Our business professions are old, going back 160 years. In the past, it was necessary to ensure that water was drinkable for the population. Today, the resource must be protected, and to ensure it is available in both quantity and quality. What drives us is the desire to serve our customers with the best technologies available. The same that motivates the students at UTC. With courage, hard work and humanity, they will succeed. With heart, work and intelligence, we can move mountains.

What message would you like to send to these young graduates on this day?

Well, in fact I have several messages to pass on. First of all, gaining general culture, together with

in-depth scientific and technological knowledge is a strong asset in today's world. Technologies are constantly evolving and UTC students are in the best position to know this. Learning in a school like UTC allows you to step into this world well prepared. The other important point that I would like to make to them, closer to my activities at Suez, is that of the environment. Indeed, environmental concerns, which are shaking the roots of our society today, are already impacting not only their studies at UTC, through courses that are always at the cutting edge of what is happening in the world, but also their future professional lives. All of them will witness extremely important changes. I invite them to reflect on this. Another message concerns the place of artificial intelligence and its societal impact. We have to be prepared for that, that's for sure. Finally, I would like to give them some advice on the international vision of things that everyone must have nowadays. I am convinced that today we must not remain only French. You have to speak several languages, live in other countries, become and stay mobile, get acquainted at first hand with other cultures and civilizations. All this is essential to success. We must not hesitate to turn to Asia, the strongest continent in terms of tomorrow's technologies.

What is France's strong point in this profoundly changing economic and technological landscape?

We must cultivate our pride in being French. In

A 2019 GRADUATION CEREMONY HELD IN A UNIQUE LOCATION



This year, the UTC graduation ceremony, with Godfather Jean-Louis Chaussade, CEO of the Suez Groupe and Chairman of the UTC Board, took place on November Saturday 23 in a unique location.

It was the star "event hall" of the the Compiègne region, le Tigre, located in the commune of Margny-lès-Compiègne, which welcomed the 800 graduates and their families on this memorable day. A special feature of the UTC is that it is during this single ceremony that the PhD, Master's and vocational Bachelor degrees were also awarded. The day was enlivened by the sports and musical performances of the student associations. It even happens that some of the teaching and educational teams take part to the game to parody their daily lives. Finally, as night fell, the Gala, organized by the Etuville association, swung into motion, for the festivities! Dress suits, evening gowns, bow ties and ties are "de rigueur" to uphold the event not forgetting the fireworks show that closed this unforgettable day! ■ PS



STÉPHANIE DAMERON

Regard sur Education & Nutrition

is also taught under the French
National Education system.

France's National Education ministry plays an important role in the health education of the youngsters. In particular, in the way they eat and the aim to eat-well. **Interactions interviewed Stéphanie Dameron, Rector of the Amiens (education regional) academy.**

Stéphanie Dameron, Rector of the Amiens Academy, prefers the term "health education" to "health promotion", as this is closer to the missions of the French National Education system and to what it implements on a daily basis in schools, colleges and high schools. "For us, health is a fundamental, transverse theme, essential to the success of our students. By giving them the keys to understanding what promotes their health and well-being, in all the meanings of this powerful term (eating well, sleeping well, moving, respecting oneself, others and one's environment), we increase their chances of success, and not only academically. Our role is to offer all our students, in a true logic of social justice, a base of knowledge enabling them to develop under good conditions," she explains. In concrete terms, this policy of "health promotion" is addressed directly and transversally at all stages of students' lives, from kindergarten to high school: through learning in class, through projects set up by the educational community, and through highlights during the year. For example, we can cite the "Bouge, une priorité pour ta santé [Move it, stay healthy]" operation, endorsed by the Mutualité Française (Insurance & Social care) and the Hauts-de-France academic region, which brings together

nearly 8 000 students every year, or the deployment of the "Free breakfast at school" operation, a great opportunity for nutrition education.

Partners at every stage

The Amiens Education academy, which has consolidated for several years a real network of stable partners, institutional or associative, thanks to these partnerships, has some tremendously important diagnostic tools at its disposal. "This is a great asset for our academy! The indicators we follow allow each territory and establishment to identify precisely its needs in terms of prevention, education and protection of students, and to adapt its health policy accordingly: obesity, diet & health, sleep, risk behaviours, addictions, sex education, road safety, physical activities... We can activate each of these levers, all of which fall within the

vast field of health promotion," continues the Rector, who also involves parents in this learning process. Parents are fully integrated into the "school community": the relationship between school/school and parents is established from the first weeks of the year with the elections of parent representatives. Elected parents sit on various official bodies, including boards of governors and health and citizenship education committees, with the aim of facilitating dialogue and collaborative work. In addition, every scheme implemented in a school, every health action carried out in a school, can have an impact on the family environment, either because parents are involved in its implementation or because their children raise their awareness in return," she concludes. Here again, we are in a logic of partnership policy and co-education." ■ KD





THREE QUESTIONS FOR...

THE CHEF, LUDOVIC COLPART,
WITH HIS 6 YEARS' EXPERIENCE AT THE
RESTAURANT "L'AUBERGE DU PONT DE
RETHONDES" IN THE OISE DEPARTMENT.



How do you ensure that good food is served every day at your restaurant without losing out on quality?

It's all a question of balance. First of all, my cuisine is very balanced. Salt, butter, cream, not too much, just the right "dosage". In my opinion, cooking is part intelligence, lots of common sense and the desire to share. To eat well, there is no secret, you have to cook. In my restaurant, we are all cooks. And, I must confess, very sadly, that there are fewer and fewer real cooks. Many just buy the produce and rework it a little. For example, we make our own sauces for meat or fish. That takes a lot of time, because the "reductions" are long. As far as pastries are concerned, I make them myself and I make sure that they are not too sweet.

You also work with UTC's Prof. Claire Rossi who conducts food studies at the Daniel Thomas innovation Centre. For what purpose?

We work together indeed, and our two skills mixed together, it's just magic. Claire Rossi studies how plant molecules work and how they react. She does physical research and I do research on flavours, particularly around cooking methods. Claire Rossi suggests solutions to replace sugar. Very effective substitutes, for example to prepare my camembert ice cream. You have to know how to innovate in cooking too. Her work on (beet) betanin is just as interesting for me. In another area, that of kitchen ware, I'm working with an expert on a system of smoked cloth filters to combat polycyclic aromatic hydrocarbons (PAHs).

You are also a trainer and member of the "Collège culinaire de France". How far does your mission of transmitting French culinary knowledge go?

The Culinary College of France has very strict requisites that allow it to train quality chefs and craftsmen. In Picardie, many of them offer excellent products, such as the Maison Bayard for potatoes, saffron from the Somme Bay or organic lentils from the Pays de Bray. The dishes we create tell all these stories. As far as training young people is concerned, it's quite difficult nowadays to find a really motivated "next generation". Our job is difficult. We are judged every day on each dish. At the Ferrandi School in Paris where I used to teach, the selection process was rigorous to find the future guarantors to uphold the standards of French gastronomy. For me, there is nothing better than in-house training. In our professions, alternating work and training studies is the future! ■ KD

OCCUPATIONAL HEALTH

An exoskeleton to prevent back pains

Often referred to as the evil of the century and the "bête noire" of companies specialized in logistics is Backache! But that may soon be a thing of the past. A team from UTC, a company and a start-up have joined forces to develop an exoskeleton capable of lifting heavy loads effortlessly!

It all started with an observation at FM Logistics: some employees can lift up to a ton of parcels a day, and back and upper limb disorders are the primary causes of work stoppages. "The health and safety of employees is a concern of the company," says Samya Bellhari-Trahin, ergonomist and occupational psychologist at FM Logistics. "We tested several devices on the market, but we couldn't identify one that met our expectations, so we decided to call in UTC experts".

"The device we are seeking must allow operators to move around in a crowded environment without difficulty. Since it has to be worn for a long time, it also has to be light and easy to put on," explains Khalil Ben Mansour, PhD in biomechanics and research engineer at the UTC-BMBI laboratory. "After identifying the constraints, we took measurements in situ, using our motion analysis platform. We then studied the data collected in the laboratory to understand the limb joint amplitudes and stresses".

After this study phase, the team developed a first prototype with the support of an engineer from Uteam*. It underwent numerous tests by motion analysis and electromyography, which made it possible to quantify its real contribution. "We have shown that its use reduces muscular forces in the back and upper limbs," adds Khalil Ben Mansour.

The team has initiated the second phase of the project, in collaboration with the start-up company



KHALIL BEN MANSOUR

Occo*, after the patent claim application in May 2019. "FM Logistics consulted us to work on user comfort, particularly on the design and weight," says Guilhem Laffont, co-manager of Occo. "We are going to deploy about ten devices, produced at Occo, in order to test them in real conditions on the premises at FM Logistics", adds Khalil Ben Mansour.

So, what is the objective for 2020? To mass-produce the ErgoSkel** to equip all the company's sites. And to finally make backaches a bad memory! ■ MB

*a UTC spin-off research contract company

** name given by the UTC to its exoskeleton. "Ergo" from Greek i.e., work and "Skel" in reference to the skeleton.

HOW DOES IT WORK?

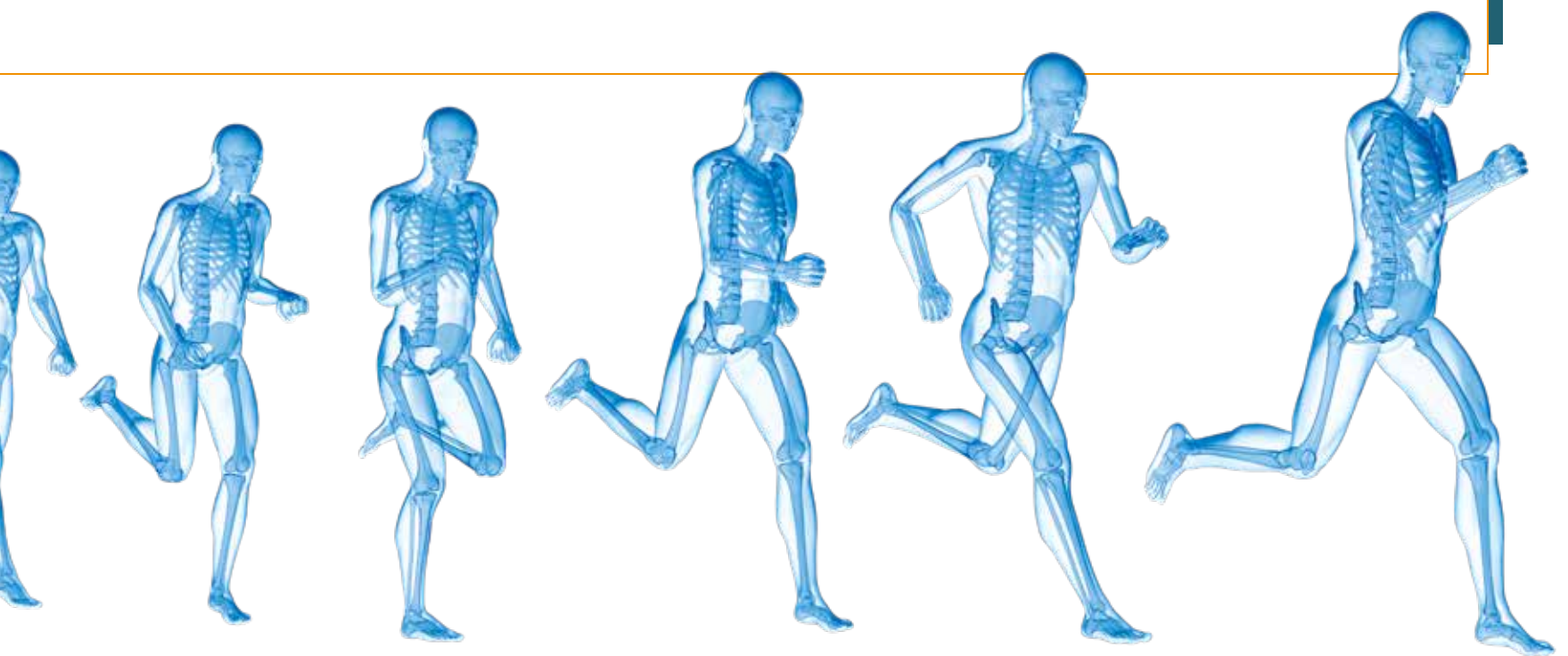
This non-robotic device is a load-bearing aid capable of relieving the body's stress/strain on the arms and back by transferring weight to the pelvic girdle. In its current form, it weighs about one kilogram and can be put on in a few seconds because it is not bulky. In addition, it does not strain the joints or the rib cage, does not interfere with breathing and prevents sweating and irritation.



ERGOSKEL
ERGOSKELETON
WHAT'S THE DIFFERENCE?

- The INRS classifies exoskeletons as: Robotic or physical assistance devices
- The ErgoSkel is a physical assistance device.





MOTION CAPTURE

Exploring the biomechanics of movement

Frédéric Marin, appointed Professor at UTC in 2009, is a lecturer-cum-research scientist at the University's Biomechanics and Bioengineering Laboratory (UTC-BMBI), investigating the biomechanics of human movements. Obesity is the subject of one of his studies and is likewise lectured to students with the help of immersive suits and situational scenarios.

If you wish to round out your education, there is nothing like practice. For his Sport & Health Technology (TSN1) course, Frédéric Marin offers a combination that works in two distinct ways. Either, in "obesity mode", to evolve with overweight or in aging simulation with reduced visual and auditory acuity, to better come to grips with the reality of an elderly persons' movements. "Both overweight and longer life expectancy at very advanced ages are part of our modern societies,

This platform is composed of several state-of-the-art motion capture systems, making it one of the most comprehensive and flexible platforms in Europe on this topic...

and concern a significant part of the population, becoming public health issues. For these young engineers, it is a question of better understanding what happens in these situations and of developing the empathy necessary here. Fitted out with these suits, they very quickly understand the biomechanical impact on their own performance. During this very comprehensive practical work, the students manipulate and experiment," explains the research scientist who set up this course with the support of the Sorbonne Universities (SU) HE cluster. Some

48 UTC students benefited from this course last semester. An idea that has been emulated, since students from the Sorbonne Universités' Health Master's programme also benefit from this active teaching method in the innovation centre and the Sport Health Technology platform equipped with 42 cameras and force sensors to characterize the performance of the neuro-musculoskeletal system. "SU's paramedical students come every year. I find this a very interesting opportunity, to be able to innovate in training and blend research with practical training," continues the scientist.

Numerous field possibilities

This interdisciplinary, collaborative and participatory thematic platform was created following the maturation of the transversal theme "Neuro-Musculoskeletal System". It is in fact composed of several state-of-the-art motion capture systems, making it one of the most complete and flexible platforms in Europe specialized on this theme. As a specialist in the biomechanics of human and animal movement, Frédéric Marin is studying the biomechanical performance of the neuromusculoskeletal system from different angles. Frédéric Marin has focused his research on joint biomechanics and musculoskeletal modelling, and has thus built up a noteworthy experience in the capture and analysis of human movement. This is supported by the technical platform 'CinDyAH' (Kinetics and Dynamics of Human Articulations) which allows the kinetic and dynamic analysis of human movement on various scales. "Dr. Khalil Ben Mansour, a research engineer, and I are working together within the Sport & Health

Technology platform on a number of fields of action. From gerontechnology to sports, from the analysis of musical performance to ergonomics. For example, we study the artistic performance of musicians in order to evaluate the impact of hours of rehearsal on joints and ligaments. With companies, we also analyse musculoskeletal disorders (MSD) associated with different practices in these industries as recently for the collaboration that Khalil Ben Mansour initiated with the company FM Logistics, for example," says Frédéric Marin who, in the field of sports activities, is conducting a major study on equestrian locomotion with the company LIM-France and the National Veterinary School of Alfort. The aim is to detect potential risks of horse injury, using tools for analysis and measurement of locomotion. ■ KD





CONTINUING EDUCATION

UTC trains in new cybersecurity skills

UTC offers two executive certificates in "cybersecurity". A successful trial run for these training courses, the first classes here graduated last February.



The cybersecurity sector is constantly evolving. This market could reach 133.8 billion \$ US by 2022. This growth reflects growing concern about threats. Cyberattacks are now part of the daily life of organizations that need to reorganize themselves to defend their interests. With this in mind, UTC has designed two certificate courses based on the requirements of the vocational training reform. "Companies, particularly from the banking sector, have asked us to do this. And we

have designed a programme based on an approach that combines our engineering students and the employees of these companies in the two certificate courses. We have devised a whole course that takes the problems of companies into account, in terms of cyber security, while guaranteeing compliance with the reference system for engineering training in the IT specialty offered by the establishment," assures François Velu, Director of Continuing Education at UTC and who is delighted with the launching of these two certificate courses back

in September 2018. He will now continue his training on "Risks and protection of information systems" and "Resilient architectures and the defence of information systems". As he puts it "this training is organized on a four-month time-sharing basis for some forty students and employees. The lectures and project-based workshops, led by professors and business experts, were appreciated by both engineering students and experienced employees". More than ever, organizations are under great pressure to recruit employees who are technically prepared for the challenges of information system security and resilience. "It should be remembered that global spending, particularly on services related to this area, is expected to reach \$103.1 billion this year alone. We observe in the HR (human resources) departments of our customers and partners a marked willingness to recruit talented employees capable of protecting their systems, and UTC is preparing them for this," concludes Véronique Fort, Deputy Director of Continuing Education at UTC. ■ **KD**



FRANÇOIS VELU

THE EUROPEAN CYBERSECURITY MONTH

Cybersecurity : well-trained students

In October, the European Cybersecurity Month highlighted this little-known area, where there is a growing demand for engineers. An update on the teaching of the specialist topic at UTC by Bertrand Ducourthial, lecturer-cum-research scientist at the UTC-Heudiasyc Laboratory and coordinator in the field of cybersecurity teaching, and Jean-Julien Alvado, co-founder of EverTrust, who graduated in computer engineering in 2003, and who lectures the CC on Computer Security.

Why teach cybersecurity?

Bertrand Ducourthial: Security is fundamental in computer science, and engineers working in this field, especially in systems and networks, have to anticipate and protect themselves against

misuse. In fact, security is a cross-cutting issue that concerns most areas of IT.

How is it taught?

Bertrand Ducourthial: The ANSSI* has established

recommendations on which we based our teaching. We also interviewed teachers and our industrial partners. Since UTC trains general engineers, all computer engineering graduates must have a basic knowledge of cybersecurity. Since autumn



2018, we have two CCs: "IT Security" and "Cyber Resilience". The latter is aimed at students interested in IT infrastructures. The courses are taught by UTC lecturers and by external lecturers (often UTC graduates themselves).

Jean-Julien Alvado : The lecturer-research scientists bring a more theoretical point of view, while external contributors, such as myself, provide expertise in the field.

What are the opportunities?

Jean-Julien Alvado: It's a constantly evolving field that companies are taking more and more seriously. It's clear that, whereas a few years ago there was no budget, especially within large companies, the situation has changed completely recently.

Bertrand Ducourthial: To meet the demand from companies, we need to train more students and better. This is our overarching ambition. These CC courses are also open to companies via the continuing education department. ■ MB

/*ANSSI - French National Information Systems Security Agency



2 CCS TO

DEEPEN YOUR KNOWLEDGE

SR06, Computer Security CC introduces computer security. It is divided into three modules of 4 weeks each: risk (analysis, ISSP, law, data storage repositories and methodologies), cryptography (algorithms, encryption and public key infrastructure) and protection (best practices, robust development, security management). Lecture course 2 h, Lab work, 2 h, on machine, lectures, projects.

SR07, Cyber-resilience This CC addresses the concepts that enable the design of cyber-resilient computer architectures, i.e., capable of dealing with system and firewall breakdowns and malevolence. It is organized in 2 modules of 4 weeks each: design of resilient architectures and defence of information systems. It is aimed at students interested in IT infrastructures.

START-UP



Well-protected data

Our personal data is worth its weight in gold; not only to us but also to cybercriminals! In order to be able to store and share it safely on the net, a team from UTC's Heudiasyc Laboratory has developed a software package that allows us to encrypt our data in just three clicks before forwarding it on the 'cloud'. Simplicity, efficiency and control of your data - that is the Datashield recipe!

THE DATASHIELD SOLUTION:

A FEW KEY POINTS

- It uses a cryptographic technique developed at the UTC-Heudiasyc Laboratory.
- It allows high-speed file-sharing transferred from a smartphone or a PC.
- It is robust and offers easy handling of the encryption codes and rights of access for the various users.
- It complies with the EU privacy directive GDPR (General Data Protection Regulation).

Today, more and more data, sometimes highly sensitive data such as our biomedical records or our financial data, is stored on shared servers such as the 'cloud'.

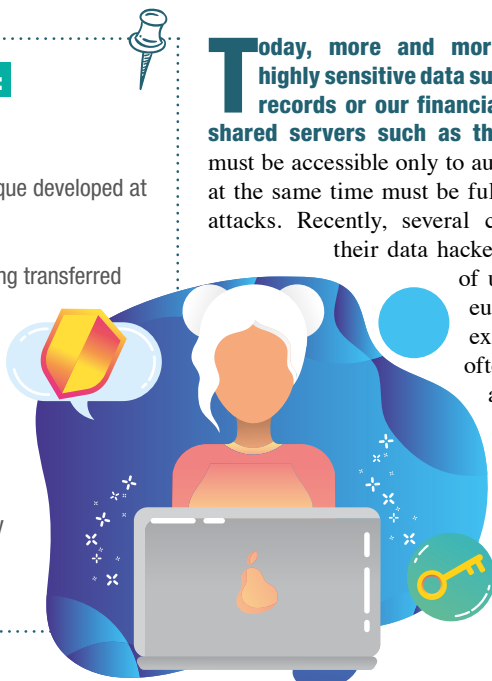
This data must be accessible only to authorized persons, but at the same time must be fully resistant to cyber-attacks. Recently, several companies have had their data hacked, resulting in losses

of up to several million euros. Solutions do exist, but they are often cumbersome and difficult to implement, especially in terms of key management. Based on this observation, Abdelmadjid Bouabdallah, Ahmed Lounis and

their team at the UTC-Heudiasyc Laboratory have developed a software they call 'Datashield'.

This software tool, developed thanks to funding via a Government Incentive award, Labex MS2T, the Regional Council and the ERDF*, and currently supported by SATT LUTECH, is very easy to use and can be "grafted" onto all existing cloud storage systems, software and platforms such as Google Drive, Dropbox, Salesforce CRM, etc. It can be used by professionals and private individuals alike, as it does not require any prior knowledge of cybersecurity. Today, the project is in the process of becoming a start-up, so that the package can be commercialized. Several companies have already expressed their interest in this novel encryption solution! ■ MB

* ERDF – the European Regional Development Fund





© Popsy Images

TIMOTHÉ PENISSON

A Resourceful Young Man

Timothé Penisson graduated in 2017 from UTC, majoring in Computer Sciences and their Applications (with the elective specialty in IT-EDP systems and networks) and joined the Bouygues Télécom Group in 2018 at the age of 24. Interactions is pleased to offer this portrait of a resourceful young man.



Timothé Penisson began his schooling at a Red Cross re-education centre in Lamorlaye (Oise), where he alternated courses and rehabilitation sessions (physiotherapy, occupational therapy, speech therapy, psychomotricity). "In my third year, I joined a class for inclusive education (CLIS 4) in Creil. Then I went to the secondary school in my village, accompanied by a 'school life assistant', and then went on to the Hugues Capet high school in Senlis, where I obtained a (Scientific) Baccalaureate S cum laudae," he explains.

Timothé Penisson is a resourceful young man. And to prove this, we cite his choice to start studying engineering. Indeed, it was during his BTS Computer Services to Organizations (SIO) that the idea of pursuing to become an engineer came to him. What motivated him? "In my opinion, the heart of this job is to design and implement innovative solutions to complex problems. Something I like very much," emphasizes Timothé Penisson.

So, how come the idea of applying to the UTC? It came to during discussions with his best friend, herself an engineering student at UTC at the time he was pursuing his BTS. "The fact that it is a public school, the possibility of choosing one's CCs and personal schedule were all decisive in my choice," he says.

Another decisive aspect was: the role of the disability advisor and the general empathy he felt. "I prepared my integration at the UTC in collaboration with Virginie Levie, the UTC disability advisor. Together, we defined the necessary adjustments so that I could follow the computer engineering course that awaited me: a CPU keyboard fitted with a finger-guide, a note-taker to attend

and help during classes, secretary and an extra 33% extra time allowed for exams", he explains.

He also found empathy among Bouygues Telecom staff during the recruitment process. "Adrien Laherre, Bouygues Telecom's disabled staff manager, asked Virginie Levie for the CVs of young graduates with disabilities. Virginie forwarded mine. After they received my CV, I was called in for an interview for a position as engineer-analyst - Security Operations Centre level 2 (SOC N2). The recruitment process resulted in my being hired on a fixed-term contract from October 2018", says Timothé Penisson.

BIO EXPRESS

1994 : born in Créteil (94), 10km South-East of Paris
2011: awarded Bac S cum laudae
2013: obtained a BTS SIO (EDP for organizations)
2017: graduated from UTC majoring in computer sciences (GI) elective specialty (SRI) EDP Systems and Networks
2018: started his career with Bouygues Telecom (major mobile phone provider)

This empathy was clear during his integration phase in the company. "My colleagues and my line manager welcomed me with kindness. They made themselves available to introduce me to Bouygues Telecom's technical environment and accompanied me in my new assignments," he adds.

My missions within the company? "I have to manage security incidents, i.e., to provide an initial analysis on receipt of an alert in order to contextualise the incident. If necessary, I carry out a more in-depth investigation and ensure that the incident is remedied and cleared by the technical teams concerned," he explains.

Any passions outside of computer engineering? "Football, ever since I was a child, music, especially Jean-Louis Aubert, former leader of the rock band Téléphone, and current affairs," says Timothé Penisson. ■ MSD



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