


# THE CARNOT NETWORK

Science that transforms society, research that has changed our lives for 20 years

Examples of Carnot-Corporate partnerships

CARNOT



Alexandre BOUNOUH,
President of the Carnot Network

# THE CARNOT NETWORK 20 YEARS OF PARTNERSHIP RESEARCH: A TIME-TESTED MODEL, A SOVEREIGN ASSET FOR TOMORROW

**By Alexandre Bounouh,**
President of the Carnot Network

Twenty years of innovations, shared challenges, and industrial successes. In 2006, the creation of the Carnot label marked a visionary act: bridging the excellence of French public research with the concrete needs of businesses. Today, as we browse through the pages of this retrospective booklet, we measure the extent of the journey accomplished. From emerging deeptech to large international companies, through our invaluable network of SMEs and mid-cap companies at the heart of our regions, this anthology of partnerships illustrates what our network does best: transforming science into value, jobs, and sovereignty.

This twenty-year milestone is not, however, a simple exercise in retrospection and self-satisfaction. It is the resounding demonstration of a model's resilience and effectiveness. Because while this booklet retraces two decades of impact, it resonates with unprecedented force against the demands of our time. Current challenges — the acceleration of energy transitions, the imperative of reindustrialization, and the quest for technological sovereignty — place partnership research more than ever at the heart of our country's economic strategy.

Building on a model that has largely proven itself, the Carnot Network moves forward with conviction and a strong sense of responsibility. Today, in 2026, I am certain of one thing: it is by consolidating our successes and revisiting our failures that we will overcome major industrial challenges. The Carnot system thus asserts itself as a formidable, high-yield strategic investment, essential for driving French competitiveness.

The milestones gathered in this work are the best proof of this. They testify to the daily commitment of our Carnots and our thousands of research professionals. They remind us that partnership research is not an abstract concept, but the fruit of a rigorous approach and of trust built over time between the academic and economic worlds. The unique alliance of the long timeframe of scientific excellence and the short timeframe of the market: this is the Carnot DNA.

As we enter the next decade, our network is ready to continue its evolution. We will continue to advocate for the clarity, stability, and ambition that our mission requires, and continue to serve the general interest.

This collection of 20 years of success is our best compass. It proves that public research, when fully and simply engaged alongside businesses, is the most reliable engine for inventing a sustainable future.

On behalf of the entire Carnot Network, I wish you an excellent read and look forward to writing, together, the next pages of French innovation.

# THE LEGACY OF A THOUGHT IN MOTION

Twenty years ago, the Carnot Network was born with a clear ambition: bringing public scientific research closer to the socio-economic world to make innovation the engine of our competitiveness. To celebrate these two decades of success and fruitful partnerships presented in this booklet, it is essential to return to our founding source: Nicolas Léonard Sadi Carnot.

## A pioneer at the crossroads of science and industry

When Sadi Carnot (1796-1832) published his sole work in 1824, Reflections on the Motive Power of Fire and on Machines Fitted to Develop that Power, he did not merely propose technical improvements to the steam engines of his time. Driven by the desire to address a national competitiveness challenge against British industry, he sought to theorize the very operation of converting heat into motion. Through this bold approach, he conceptualized the ideal cycle (the Carnot cycle) and formulated the second law of thermodynamics, long before the term «thermodynamics» was coined. Sadi Carnot thus embodies the quintessence of modern partnership research: starting from a concrete industrial need to achieve a major, universal, and timeless scientific discovery.

## A technological resonance at the heart of our daily lives

Carnot's work has not remained frozen in the annals of theoretical physics; it has fueled the entire industrial revolution and continues to shape our society. His discoveries inevitably govern the operation of devices used by each of us every day. Whether it is the internal combustion engine of our vehicles, the cooling system of our refrigerator, or the heat pump at the heart of our buildings' energy transition, all obey the thermodynamic laws he brought to light.

## Towards legitimate national recognition

The genius of Sadi Carnot, while globally celebrated by the scientific community, deserves public consecration commensurate with his civilizational impact. This is the whole meaning of the panthéonisation project (induction into the Panthéon), which brings together leading scientific, academic, and industrial figures alongside the Carnot family. Inducting Sadi Carnot into the Panthéon means honoring science when it serves technological progress and the influence of France.

## 20 years of innovation in action

The examples of collaborations between our institutes and the companies that punctuate this booklet are the worthy heirs of this spirit. From the pioneering start-up to the large industrial group, each partnership illustrates our commitment to transforming academic excellence into useful, sustainable, and value-creating innovation. May the discovery of these 20 years of successes inspire you and testify that the spirit of Sadi Carnot, two centuries later, has never been so alive.



# A NETWORK ESTABLISHED IN EVERY REGION OF FRANCE



# KEY FIGURES OF THE CARNOT SYSTEM SINCE 2006

INDICATORS OVER 20 YEARS

500 000 ETP | 35,000 FTE
RESEARCHERS

7,500 M€ | 595 M€
CONTRACTS

16,500 | 900
PATENTS

660 M€ | 57 M€
LICENCES

ANNUALIZED FIGURES



# Examples of Carnot-Corporate partnerships






## Carnot 3BCAR

**TBI-Nereus Partnership: production of nitrogen fertilizers from digestate.**

The TBI laboratory, a member of Carnot 3BCAR, and the company NEREUS collaborated for 4 years on the development of a technology enabling the fractionation of digestates and the production of reusable water, based on nano-filtration (NF) combined with a process for extracting ammoniacal nitrogen through hydrophobic membranes (Transmembrane Chemical Absorption, TMCS). A semi-industrial scale pilot was designed and the operating conditions optimized, leading to the development of a global model to understand scaling changes for this technology, in collaboration with CRITT GPTE, a member of Carnot 3BCAR.

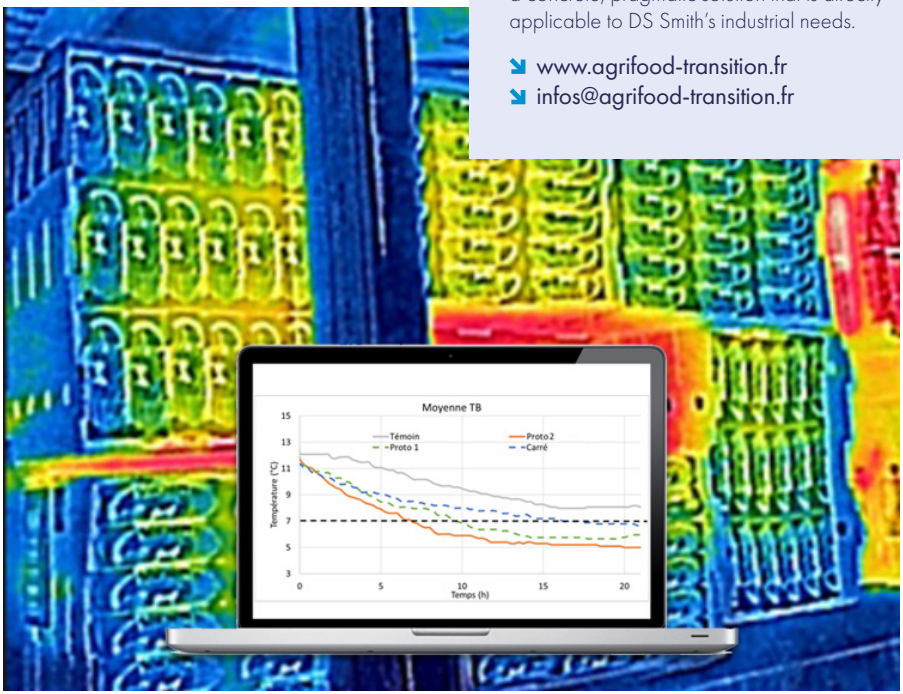
3bcar@instituts-carnot.fr
victor.stimpfling@inrae.fr

## Carnot AgriFood Transition

**DS Smith and Carnot AgriFood Transition: optimizing the cold chain.**

DS Smith partnered with Carnot Agrifood Transition, via the Pôle Cristal team, to optimize the thermal behavior of its food packaging and guarantee a homogeneous temperature during storage. Through numerical simulations and practical tests, this collaboration improves thermal performance while optimizing storage space and energy consumption. Scientific expertise applied to a concrete, pragmatic solution that is directly applicable to DS Smith's industrial needs.

- www.agrifood-transition.fr
- infos@agrifood-transition.fr



## Carnot AP HP

**An agreement between Carnot AP HP and Siemens Healthineers to improve the quality of care through innovative technologies.**

Siemens Healthineers and AP-HP signed a framework agreement, marking a major milestone in their collaboration. AP-HP becomes the first healthcare institution to adopt this new partnership model, driving an innovative dynamic between the two organizations, beyond standard clinical collaborations.

- www.aphp.fr
- institut-carnot.aphp@aphp.fr






## Carnot ARTS

**ICARE Joint Laboratory with Safran: Material fatigue and aeronautical innovation.**

After more than 10 years of collaboration on the fatigue characterization of materials through their thermal signature, materialized by the scientific advances made within the Self Heating research chair, the IRDL laboratory and Safran are creating the ICARE joint laboratory.

- www.ic-arts.eu
- contact@ic-arts.eu



## Carnot Calym

**The Carnot CALYM Institute, a strategic partner of the pharmaceutical industry for the development of new therapies in hematological malignancies.**

Through the clinical research networks of its academic cooperative groups, IFM (Intergroupe Francophone du Myélome) and LYSA (Lymphoma Study Association), the Carnot CALYM Institute supports pharmaceutical companies in the design and conduct of large-scale international clinical trials. In a highly globally competitive therapeutic research and innovation environment, this ability to mobilize scientific expertise, clinical investigation networks, and patients is a major asset in accelerating the evaluation of new therapeutic strategies.

Two recent partnerships evaluating a chemotherapy-free immunotherapy strategy illustrate this dynamic:

- IFM-Pfizer Partnership: ELLEN trial on multiple myeloma
- LYSA/LYSARC-Roche Partnership: MorningLyte trial on follicular lymphoma

These two collaborations illustrate the Carnot CALYM Institute's ability to structure ambitious R&D partnerships with the pharmaceutical industry and to contribute to the development of therapies capable of transforming the standard of care for hematological malignancies.

↘ www.calym.org/en
↘ hello@calym.org



## Carnot CEA LETI

**ONWARD® Medical signs an agreement with the CEA to obtain exclusive rights to Clinatec's WIMAGINE® brain-computer interface (BCI) technology.**

The company ONWARD® Medical obtains exclusive rights to integrate the brain-computer interface (BCI), WIMAGINE®, developed by CEA researchers, into its ARCBCI™ system. The WIMAGINE BCI has up to 7 years of clinical safety data on human patients. This agreement offers ONWARD® Medical the opportunity to be first to market with a BCI-activated system to restore thought-guided movement after paralysis.

- www.leti-cea.fr/cea-tech/leti
- cecile.moulin@cea.fr



## Carnot CEA LIST

**Safran x CEA-List.**

To meet Safran's non-destructive testing (NDT) optimization needs, we have created the digital twin of a robotic inspection cell. By coupling infrared thermography, automatic calculation of robotic trajectories, and a digital twin, we have significantly reduced robot programming times, cell downtime, and the risks of damaging the part.

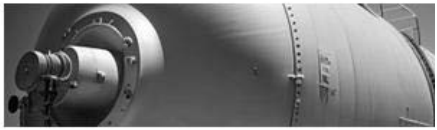
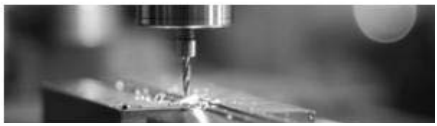
- www. list.cea.fr/fr
- gwenael.toullelan@cea.fr









## Carnot Cetim

**From laboratory to production: LISI AEROSPACE and Carnot Cetim innovate in tightening.**

Developing, by 2027, an efficient, reliable, easy-to-use tightening tension measurement and control equipment that can be integrated into production: this is the goal of the Digifast research collaboration with Lisi Aerospace, targeting the requirements of the aeronautics sector and other industries. Continuing its R&D program, this partnership aims to validate assumptions regarding the robustness and reliability of a technology based on an external sensor with an integrated dry coupling agent. Carnot Cetim was called upon for its understanding of the tightening phenomenon across broad sectoral applications and to study the feasibility of its pre-industrialization.

- www.cetim.fr
- helene.determe@cetim.fr









## Carnot Chimie balard Cirimat

**Synia: Innovative bio-based PolyUrethane resin intended for Doming.**

The Carnot Chimie Balard Cirimat and Synia have developed an innovative bio-based polyurethane resin intended for doming, incorporating up to 90% bio-based carbon to reduce the use of fossil resources. Originating from a CIFRE thesis, this partnership led to the filing of two international patents and the industrialization of a formulation meeting the sustainability and stringent requirements of the luxury sector. Awarded the Carnot Prize 2023, this collaboration illustrates the ability of partnership research to transform a scientific innovation into an industrial solution with high environmental impact.

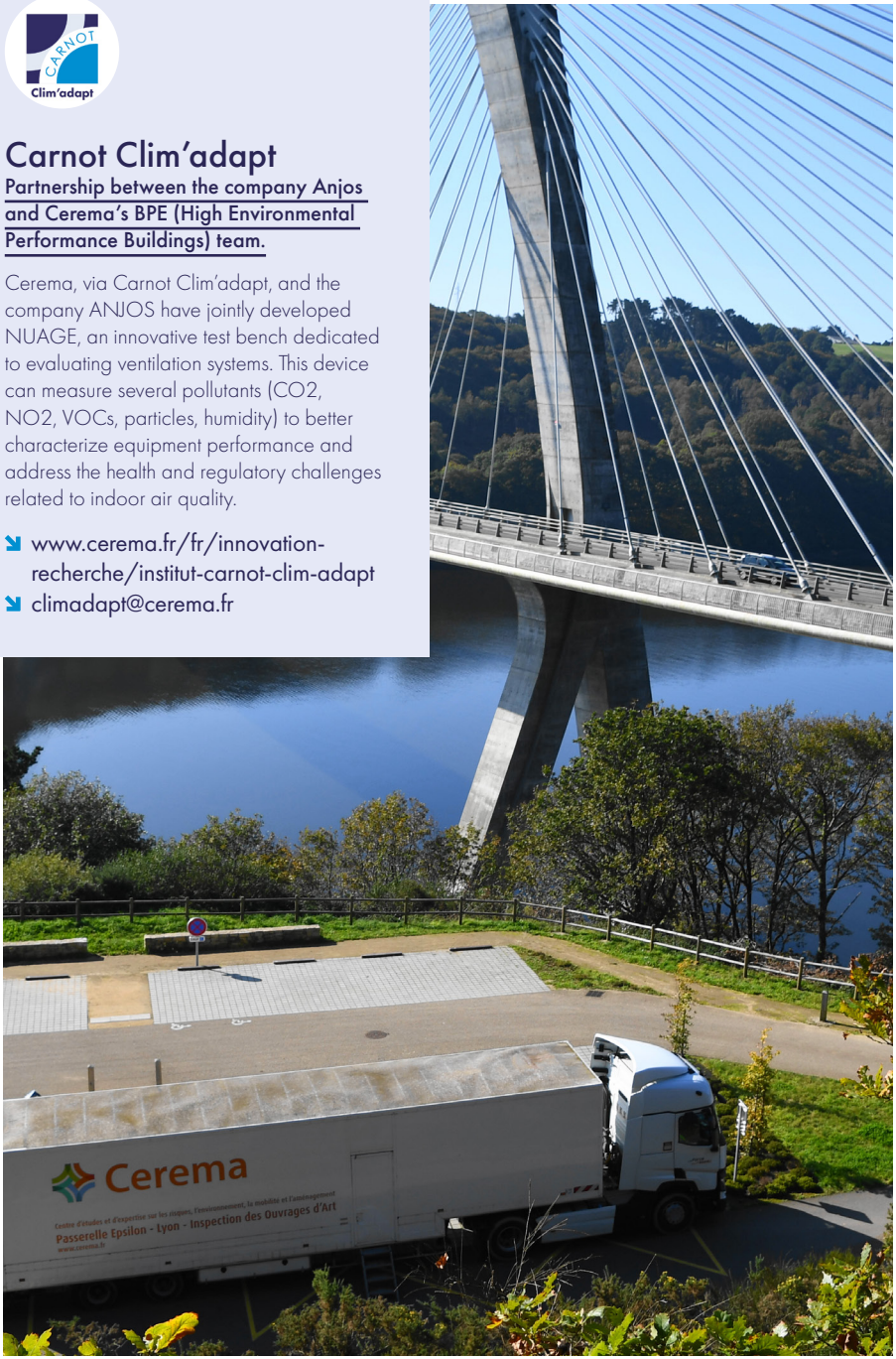
- www. carnot-chimie-balard-cirimat.fr
- contact@carnot-chimie-balard-cirimat.fr

## Carnot Clim'adapt

**Partnership between the company Anjos and Cerema's BPE (High Environmental Performance Buildings) team.**

Cerema, via Carnot Clim'adapt, and the company ANJOS have jointly developed NUAGE, an innovative test bench dedicated to evaluating ventilation systems. This device can measure several pollutants (CO2, NO2, VOCs, particles, humidity) to better characterize equipment performance and address the health and regulatory challenges related to indoor air quality.

- www.cerema.fr/fr/innovation-recherche/institut-carnot-clim-adapt
- climadapt@cerema.fr





## Carnot cognition

**Contract with Asmodee company.**

Asmodee is one of the global leaders in board games. Established in over 20 countries and with nearly a billion in revenue, it has developed a scientific approach to board games through its Game in Lab research support program.

Subject: the impact of playing games on cognitive functions in adults and adolescents, in relation to their academic success.

This project helped understand how gaming can improve cognitive performance, such as memory or attention. To do this, they conducted cognitive tests on adolescents and young adults. Today, there is a lot of data on video games and less on board games, yet there is a growing interest in legitimizing them.

- www.institut-cognition.com
- contact@institut-cognition.com

## Carnot Curie Cancer

**A molecule originating from the Institut Curie and developed by Biomunex, licensed to Ipsen.**

In 2025, a molecule derived from a technology co-invented by the Institut Curie and Biomunex reached a key milestone with the signing of a licensing agreement with Ipsen. Based on multispecific antibodies, this innovation opens new perspectives for cancer treatment, particularly solid tumors. With Ipsen joining its development, it scales up and illustrates the Institut Curie's ability to transform scientific advances into solutions for patients.

- www.curie.fr
- techtransfer@curie.fr





## Carnot Eau & Environnement

**Active «gammarus» biomonitoring for water quality assessment.**

Two researchers from Carnot Eau & Environnement have created a biomonitoring tool that allows monitoring and detecting contamination and toxicity in watercourses. This tool led to the creation of a start-up, followed by the signing of an Associated Partnership Laboratory.

Water is recognized as a common good whose quality must be preserved to sustainably ensure the diversity of its uses in response to human and ecological needs. The work conducted within the RIVERLY unit's ecotoxicology laboratory since 2005 resulted in an active biomonitoring methodology that was well-received by aquatic environment managers. It is in this context that the operational transfer of these methods took place via the creation and initial hosting at INRAE of the company Biomae in 2014, facilitated by funding from Carnot Eau & Environnement.

- www.carnot-eau-environnement.fr
- carnot-eauetenvironnement@inrae.fr




## Carnot Énergies du Futur

**CEA-Liten and INOCEL combine their expertise to develop a new generation of high-power fuel cells.**

This breakthrough technology (15 CEA-Liten patents) offers performance significantly superior to solutions currently available on the market: peak power exceeding 300kW, high energy density, and a ramp-up to full power in a few seconds. INOCEL designs and develops zero-emission generators based on low-temperature fuel cells, intended to replace high-power internal combustion engines.

- www.energiesdufutur.fr
- carnotenergiesdufutur@grenoble-inp.fr



## Carnot ESP

**FLAMES Joint Laboratory: Fire Laboratory for Assembly, Metal and Composite Engineering & Safety.**

This innovative joint laboratory, supported by Safran, INSA Rouen Normandie, the University of Rouen Normandie, and the CNRS, is located within GPM and CORIA, two laboratories that are members of Carnot ESP.

Objective: to enhance the fire safety of aircraft nacelles by anticipating future regulations in the aeronautics sector.

This project brings together:

- highly technical testing facilities,
- a mixed team of researchers/engineers,
- a thesis dedicated to composite materials,
- and a cross-disciplinary simulation/experimentation approach.

FLAMES fully embodies the mission of the Carnot ESP institute: addressing industrial challenges through science, in the service of safer and more sustainable mobility.

- www.carnot-esp.fr
- contact@carnot-esp.fr

# Carnot France Futur Élevage

**From the Intercarnot project (AIDAV) to a Start-up: detecting respiratory infections in livestock.**

The start-up originated from an interCarnot project AIDAV (Innovative Approaches for the Detection of Respiratory Viral Agents in Cattle) between Carnot France Futur Élevage and CEA LETI. AIDAV relies on the detection of respiratory viruses in the exhaled air of cattle. The CEA-Leti developed an innovative method that led to Nawu Diagnostics, a start-up offering a rapid and non-invasive diagnostic device for livestock farming.

- www.francefuturelevage.com
- contact@francefuturelevage.com





## Carnot I2C

**Sustainable synthesis and property studies of new mycosporine-like amino acid analogs from levoglucosenone: new bio-based UV filters for the cosmetics industry.**

Since 2023, the public-private consortium bringing together URD ABI - AgroParisTech, URCOM - ULHN, and LVMH Recherche has been developing the LAGOON project, aiming for bio-based alternatives to sunscreens. Mycosporine-like amino acids (MAAs), capable of naturally filtering UV rays, are at the heart of this sustainable approach. URD ABI designs bio-inspired analogs, while the University of Birmingham investigates their anti-UV mechanisms. The most promising molecules are formulated by LVMH, while URCOM, a member of Carnot I2C, develops a methodology to assess their fate and ensure skin safety.

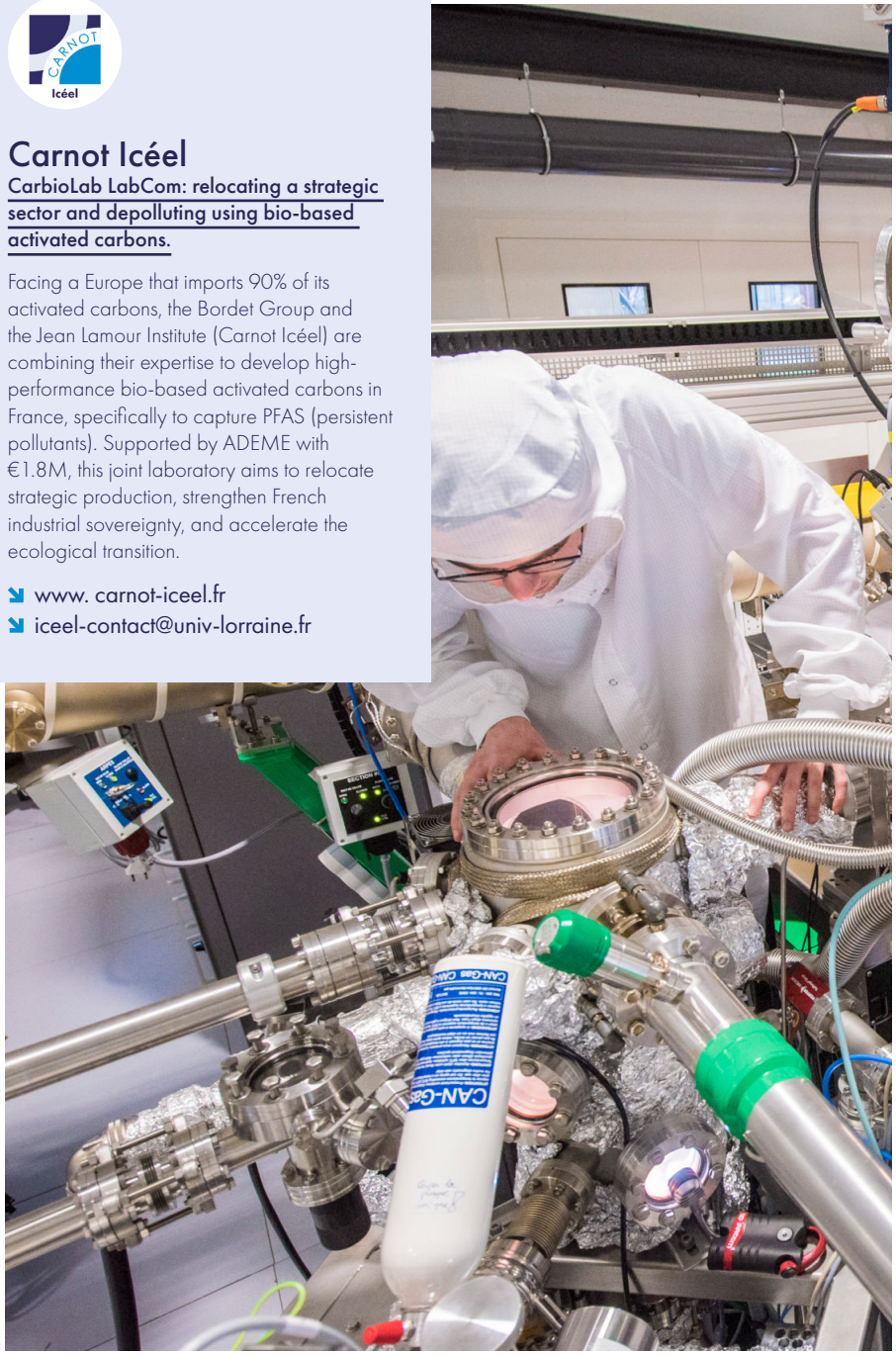
- www.carnot-i2c.fr
- contact-i2c@normandie-univ.fr

## Carnot Icéel

**CarbioLab LabCom: relocating a strategic sector and depolluting using bio-based activated carbons.**

Facing a Europe that imports 90% of its activated carbons, the Bordet Group and the Jean Lamour Institute (Carnot Icéel) are combining their expertise to develop high-performance bio-based activated carbons in France, specifically to capture PFAS (persistent pollutants). Supported by ADEME with €1.8M, this joint laboratory aims to relocate strategic production, strengthen French industrial sovereignty, and accelerate the ecological transition.

- www. carnot-iceel.fr
- iceel-contact@univ-lorraine.fr





## Carnot IFPEN Ressources Énergétiques

**A solution dedicated to self-consumption optimization - Carnot IFPEN Ressources Energétiques and SOALIS.**

Carnot IFPEN Ressources Énergétiques and SOALIS sign a partnership to commercialize NOE, an offer for optimizing self-consumption. Companies will be able to halve their electricity bills while optimizing their daily energy consumption.

- www.ifpenergiesnouvelles.fr
- olga.vizika-kavvadias@ifpen.fr

# Carnot IFPEN Transports Energie

**Carnot IFPEN Transports Energie partners with Cambridge GaN Devices (CGD) to develop next-generation inverters.**

Carnot IFPEN Transports Energie has signed a collaboration agreement with Cambridge GaN Devices (CGD), a semiconductor company offering a range of wide-bandgap GaN (gallium nitride) and high-energy-efficiency components, to develop an innovative inverter for electric mobility based on advanced GaN devices.

- www.ifpenergiesnouvelles.fr
- olga.vizika-kavvadias@ifpen.fr







## Carnot Imagine

**From gene discovery to a new therapy for patients with achondroplasia.**

In 1994, at the Necker-Enfants Malades Hospital, Dr. Laurence Legeai-Mallet participated in the identification of the FGFR3 gene responsible for achondroplasia. Her work then helped better understand the disease and validate the repositioning of Infigratinib as a potential treatment.

In 2018, BridgeBio created QED Therapeutics to develop this molecule for achondroplasia and initiated a partnership with Dr. Laurence Legeai-Mallet's team at Carnot Imagine.

This work demonstrates the treatment's efficacy in a unique murine model, leading to a clinical trial in 2021 and the treatment of the first French patient in 2022 at Necker.

In 2025, the PROPEL3 trial reached the end of enrollments, paving the way for marketing authorization (MA / AMM). In parallel, the ACCEL2/3 study is starting, and an international dynamic is developing, notably in Japan with the launch of the AOBA clinical trial by Kyowa Kirin.

- www.institutimagine.org/fr
- industrial.partnerships@institutimagine.org



## Carnot Ingénierie @Lyon

**Partnership between Saint Gobain and teams from INSA Lyon, Claude Bernard University, and the CNRS: MATILDE / Inorganic materials: Innovative strategies to control damage.**

Objective: to develop higher-performance materials while reducing their carbon footprint and the use of the planet's resources. To meet this challenge, it brings together materials science experts from academic and industrial research: MATEIS (INSA Lyon/UCBL/CNRS), LAMCOS (INSA Lyon/CNRS), and three Saint-Gobain research centers - Recherche Provence, Recherche Compiègne, and Recherche Paris. Its originality lies in combining, on one hand, expertise in materials, their shaping processes at the laboratory or industrial pilot scale, and their microstructural characterization, and on the other hand, expertise in numerical simulation.

- www.ingenierie-at-lyon.org
- institut.carnot@ingenierie-at-lyon.org



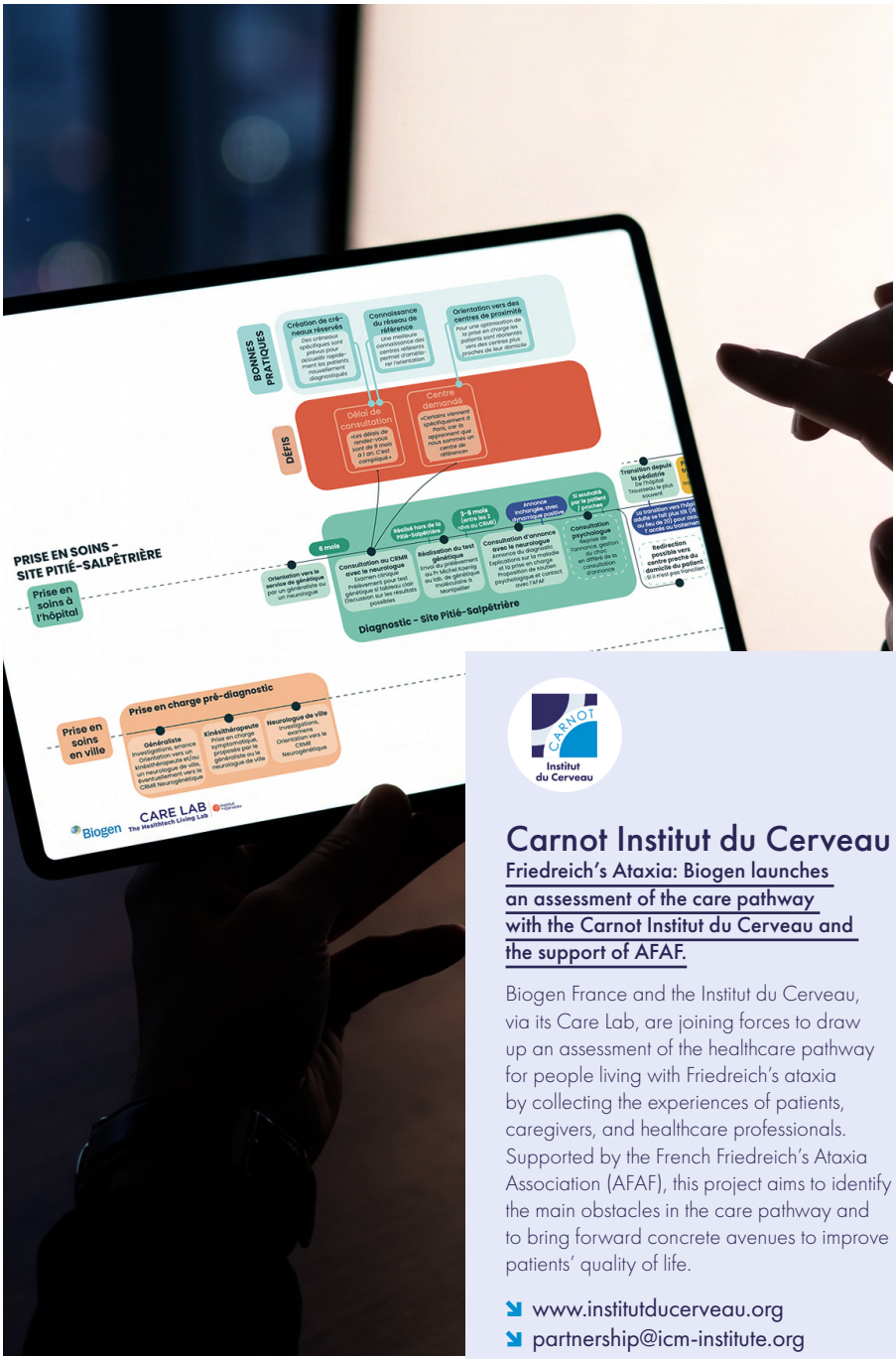



## Carnot Inria

**Carnot Inria and Hope Valley AI: a collaboration serving innovation in healthcare.**

HOPE VALLEY AI® develops next-generation digital AI laboratories dedicated to scientific and technological research in digital oncology, natively integrating rare event risk engineering. These intelligent autonomous laboratories are orchestrated by proprietary foundation models and expert AI hyper-agents (co-researchers, data scientists, risk engineers, and experts in intellectual property and industrial valorization), acting as an augmented research AI force.

- www.inria.fr/fr
- ici@inria.fr



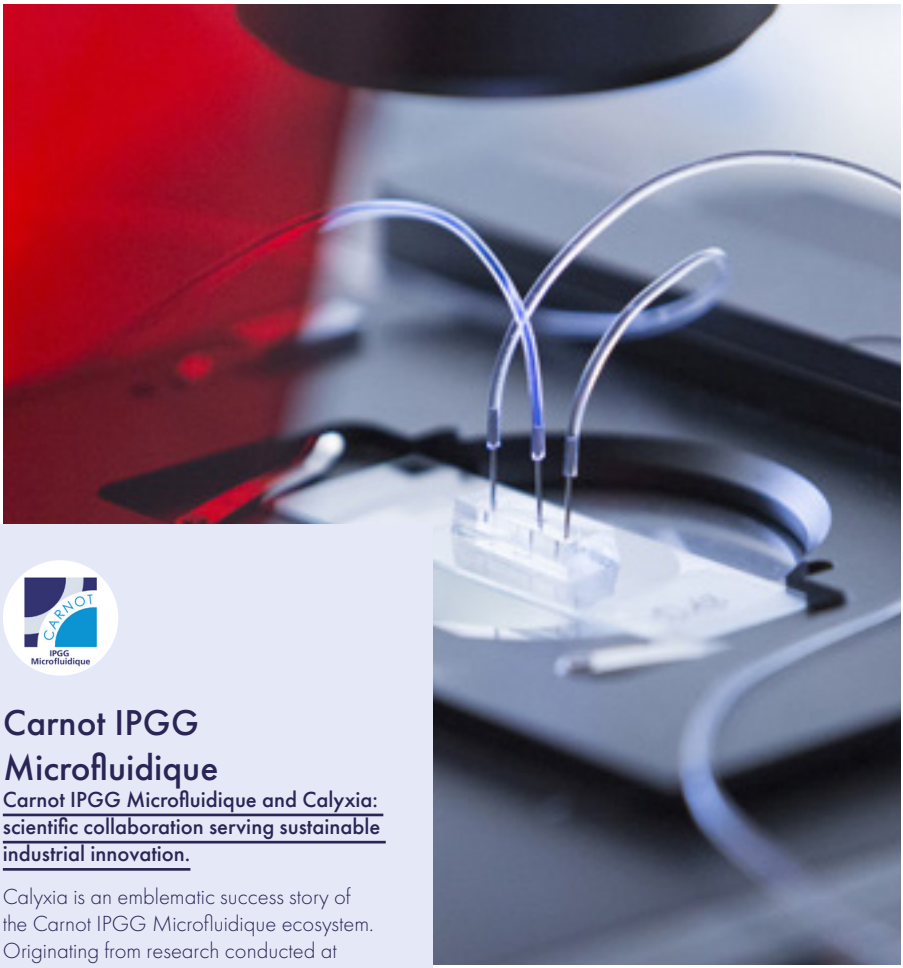

CARNOT
Institut du Cerveau

## Carnot Institut du Cerveau

### Friedreich's Ataxia: Biogen launches an assessment of the care pathway with the Carnot Institut du Cerveau and the support of AFAF.

Biogen France and the Institut du Cerveau, via its Care Lab, are joining forces to draw up an assessment of the healthcare pathway for people living with Friedreich's ataxia by collecting the experiences of patients, caregivers, and healthcare professionals. Supported by the French Friedreich's Ataxia Association (AFAF), this project aims to identify the main obstacles in the care pathway and to bring forward concrete avenues to improve patients' quality of life.

- www.institutducerveau.org
- partnership@icm-institute.org

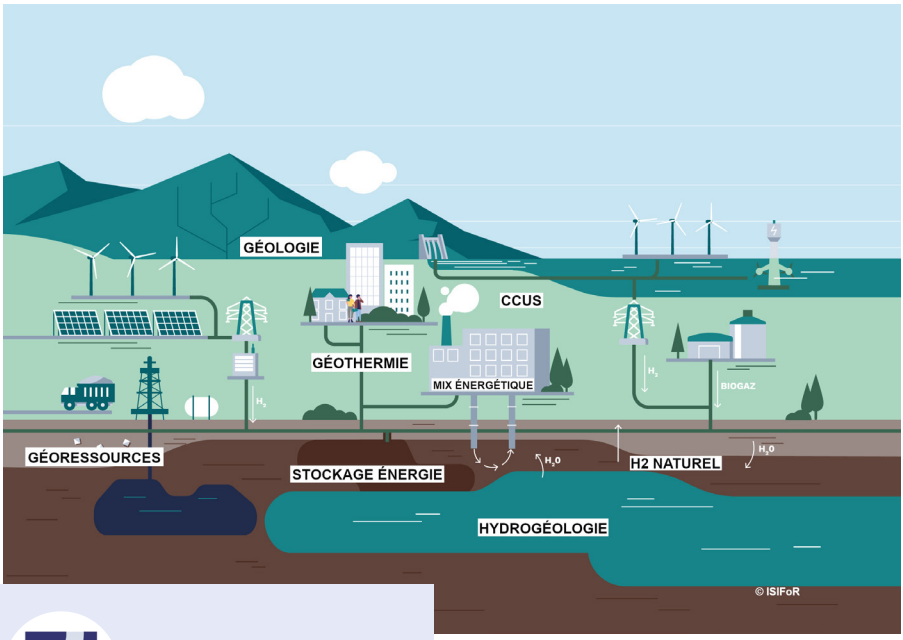


# Carnot IPGG Microfluidique

**Carnot IPGG Microfluidique and Calyxia: scientific collaboration serving sustainable industrial innovation.**

Calyxia is an emblematic success story of the Carnot IPGG Microfluidique ecosystem. Originating from research conducted at the interface of microfluidics, chemistry, and materials, the company has developed a biodegradable microencapsulation technology that is now deployed on an industrial scale. In 2024, Calyxia raised $35M to accelerate its international growth and strengthen its production capacities, illustrating the ability of research conducted within PSL and IPGG to transform into industrial innovations with high environmental impact.

- www.institut-pgg.fr/Presentation-du-Carnot-IPGG_266.html
- carnot.ipgg@psl.eu

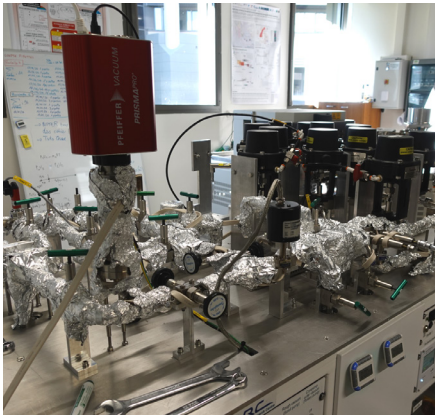



## Carnot ISIFoR

**Carnot ISIFoR supports research and companies in their R&D related to geo-resources (gas storage, geothermal energy, managing the energy mix, native subsurface gases...).**

In April 2024, a truly exceptional tool was launched. Named ELEM SPOT: it allows the analysis of certain biofuel constituents to improve them and make them suitable for use by vehicles (specifically Sustainable Aviation Fuels). It was developed by Shimadzu, TotalEnergies, UO (Universidad de Oviedo), and UPPA (University of Pau and the Adour Region (several of whose laboratories participate in Carnot ISIFoR)). This result is the materialization of long-term collaborative work spanning over a decade, which has notably resulted in several patents.

- www.carnot-isifor.eu
- virginie.caturla@univ-pau.fr



## Carnot LSI

**The start-up Nveil, emerging from Carnot LSI, addresses a major challenge: exploiting complex data without visual bias.**

An AI-based visualization software that reveals the full richness of your data. The software analyzes, advises, and generates relevant visualizations that will instantly identify the information you are looking for, with the least possible interpretation bias. Seeing better to understand better. This is Nveil's mission, aiming to make your data accessible and its visualization intuitive within a virtual environment (mixed reality/VR/AR).

- www.carnot-lsi.com
- contact@carnot-lsi.com







## Carnot M.I.N.E.S

**IMT Mines Albi's research in collaboration with the company PRAYON in the field of phosphates bears fruit for environmental protection.**

Developing phosphate-based materials for use in energy storage, wastewater and industrial smoke cleanup, or for new applications in the agri-food and food sectors, these are the achievements resulting from IMT Mines Albi's collaboration with the company PRAYON, a world leader in the chemistry of purified phosphoric acid and phosphates. In 2024, the two partners renewed their collaboration within the framework of a joint laboratory named «Phosforlab 2» to deploy these research results on an industrial scale. Initiated 15 years ago, this collaboration relies on the unique expertise in Phosphate Engineering for Energy and the Environment from the RAPSODEE research center at IMT Mines Albi.

- www.carnot-mines.eu
- contact@carnot-mines.eu

## Carnot MECD

**Joint Laboratory between LMDC (University of Toulouse, INSA Toulouse), a member of Carnot MECD, and the company ECOCEM.**

Created in 2022 after several years of collaboration between LMDC and the company Ecocem, the Orison joint laboratory (carbon neutrality InStitute for cements) develops R&D activities aimed at reducing the carbon footprint of hydraulic binders and their applications, by valorizing not only blast furnace slag but also a whole range of natural materials and industrial co-products.

- www.mecd.fr
- projet@mecd.fr





## Carnot MERS

**VERTI-LAB, a joint laboratory between Ifremer, co-founder of Carnot MERS, and the company HYDROQUEST at the heart of the energy transition.**

The research aims to develop and validate the behavior of vertical-axis tidal turbines in high-intensity currents. Researchers are particularly working on the influence of sea states on materials and their interactions with the marine ecosystem. The pilot farm planned by HYDROQUEST will be the most powerful in the world and will contribute to the recognition of this new industry, based on the exploitation of predictable, renewable energy.

- www.carnot-mers.com
- innovation@carnot-mers.com

## Carnot MICA

**Nano Inks developed by Karine Mougin, teacher-researcher at IS2M and member of Carnot MICA, are revolutionizing color through a hybrid material without pigments.**

Stemming from a strategic partnership between IS2M and the BIC company, these plasmonic inks rely on an innovative hybrid material formulated without traditional pigments or dyes. For manufacturers, this technology represents an opportunity to reinvent color while meeting sustainability and performance challenges.

- www.carnot-mica.fr
- contact@carnot-mica.fr



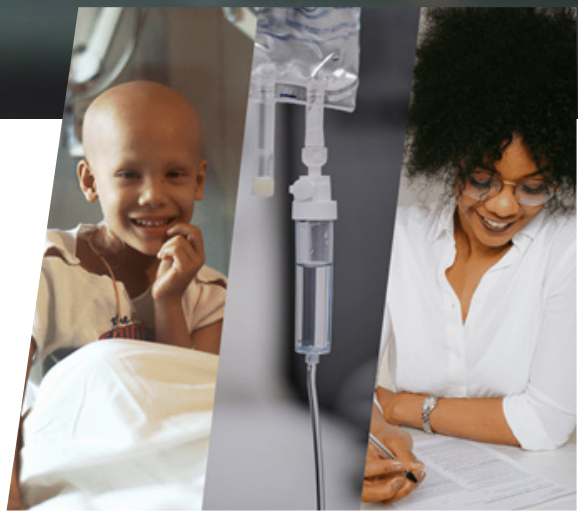
# Carnot OPALE

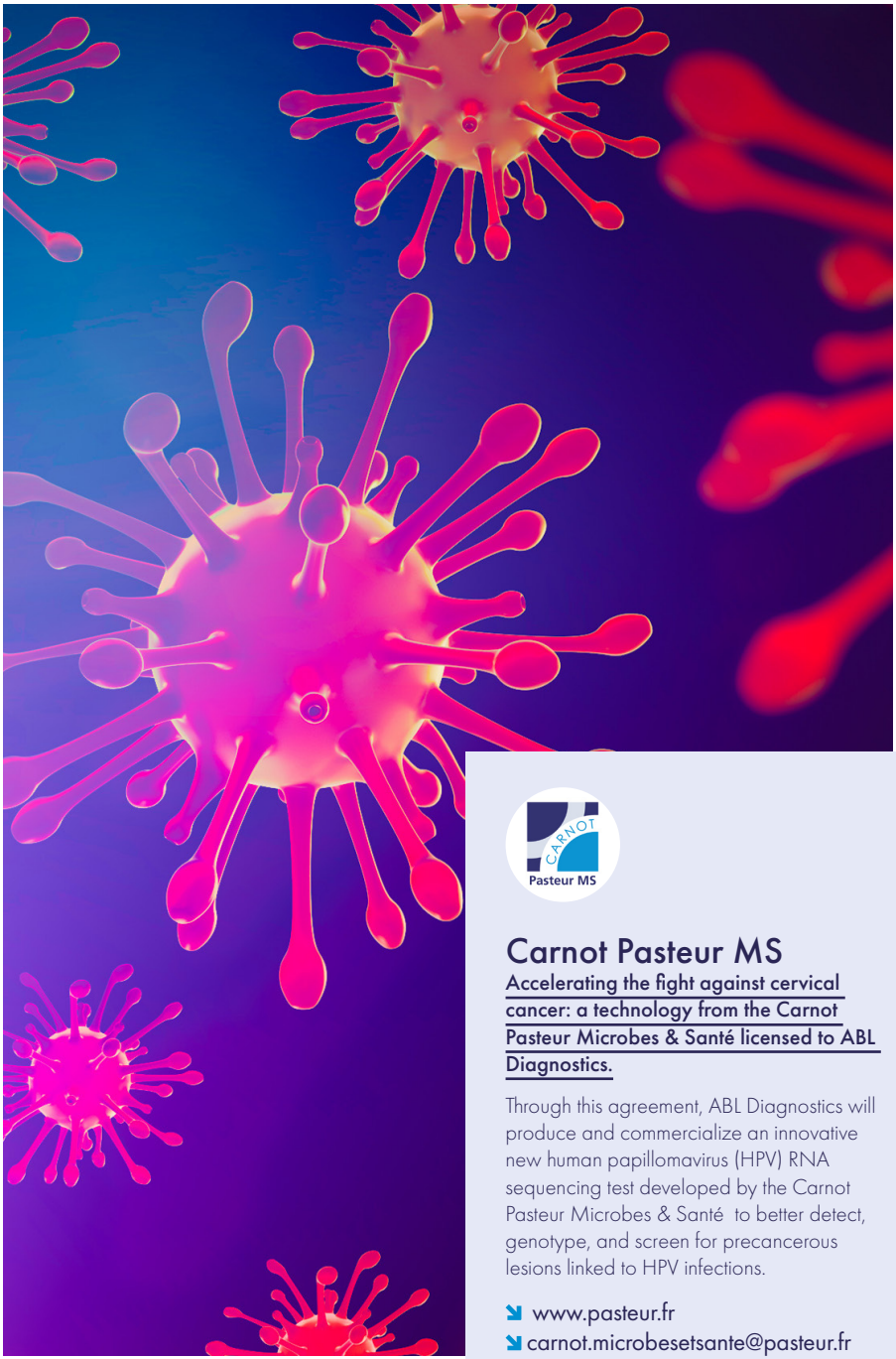
**GRAALL-2014: halving transplants in acute lymphoblastic leukemia through precision medicine.**

Carnot OPALE federates a national network of clinical and research teams dedicated to leukemias, enabling the conduct of large-scale multicenter trials. Within this framework, teams from the consortium contributed to the international GRAALL-2014 trial, coordinated by the GRAALL cooperative group, in adults with Ph-negative acute lymphoblastic leukemia. The study evaluated an innovative therapeutic strategy combining age-adapted treatment intensity and a transplant decision guided by minimal residual disease (MRD), a biomarker measuring the persistence of leukemic cells after treatment.

- www.opale.org/fr
- contact@opale.org







## Carnot Pasteur MS

**Accelerating the fight against cervical cancer: a technology from the Carnot Pasteur Microbes & Santé licensed to ABL Diagnostics.**

Through this agreement, ABL Diagnostics will produce and commercialize an innovative new human papillomavirus (HPV) RNA sequencing test developed by the Carnot Pasteur Microbes & Santé to better detect, genotype, and screen for precancerous lesions linked to HPV infections.

- www.pasteur.fr
- carnot.microbesetsante@pasteur.fr

## Carnot Plant2Pro

**Better controlling the drift of viticultural spraying.**

The EoleProtect project, supported by Carnot Plant2Pro, is developing prototypes to test different viticultural spraying techniques under semi-controlled wind conditions. This work improves the reliability of drift measurements and strengthens the appeal of the EoleDrift test bench for R&D collaborations with spraying equipment manufacturers.

- www.plant2pro.fr
- plant2pro@instituts-carnot.fr





## Carnot PolyNat

**Citeo collaborates with CTP (Carnot PolyNat) to eco-design sustainable, reliable packaging that is compatible with existing recycling streams.**

The replacement in bindings of glues, which disrupt recycling, with ultrasonic welding. This technological innovation reduces energy consumption by up to 70% and remains compatible with existing industrial lines.

- www.polynat.eu/fr
- polynat@cermav.cnrs.fr

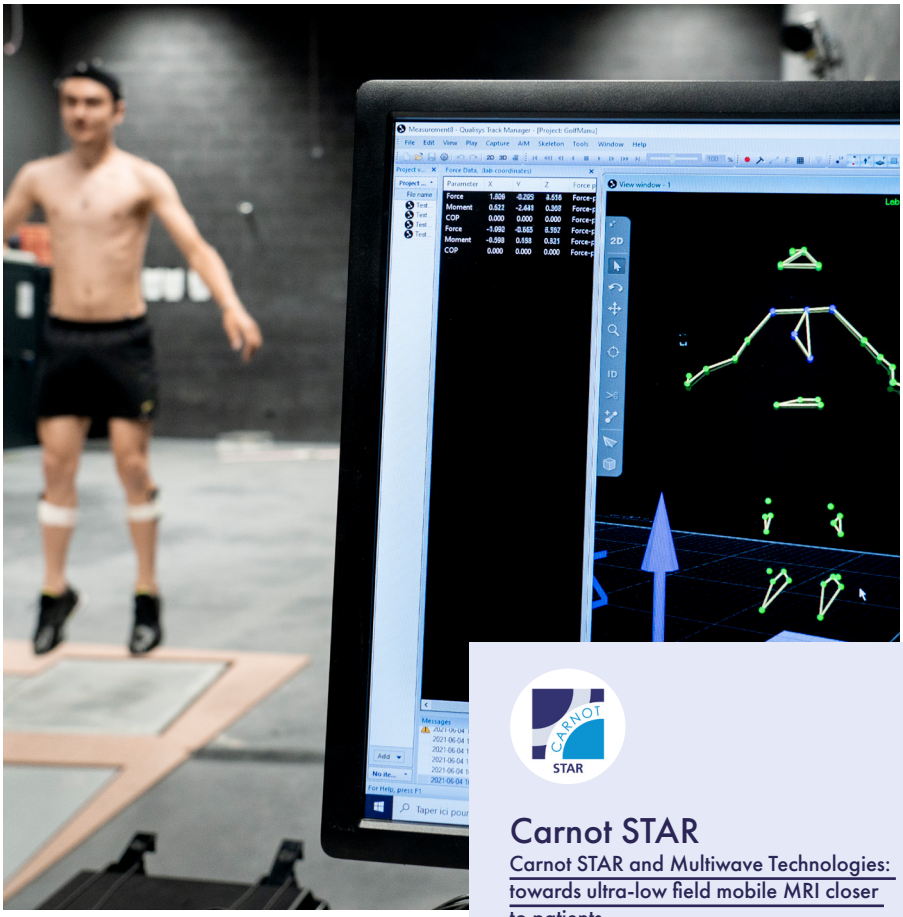
## Carnot Qualiment

**Based on a patent filed following a project funded by Qualiment and led by UMR Micalis, Carembouche uses the power of the microbiota to promote food intake in the elderly and prevent their undernutrition.**

Carembouche is innovating in the oral nutritional supplement market by adding a probiotic on top of the required protein and energy intakes. Proteins help build muscles, and probiotics increase protein assimilation. The start-up is also innovating through new formats, creating appetizing, colorful, and easy-to-eat «finger foods.» Carembouche thus exploits an innovation in usage through Finger Food and a technological innovation by associating probiotics.

- www.qualiment.fr
- qualiment@inrae.fr





## Carnot STAR

**Carnot STAR and Multiwave Technologies: towards ultra-low field mobile MRI closer to patients.**

Carnot STAR initially co-funded a project born in 2017 between two laboratories: the Fresnel Institute and CRMBM, to improve the quality of ultra-low-field MRI. They were quickly joined by the company Multiwave Technologies to create an industrial chair. Today, the teams are presenting a convincing prototype that soon envisions ultra-low-field MRI devices capable of imaging the brain as well as the musculoskeletal system. The goal is to provide a mobile pre-diagnostic tool to bring it closer to the needs (sports fields, isolated areas...).

- www.carnotstar.univ-amu.fr
- www.carnotstar.univ-amu.fr/fr

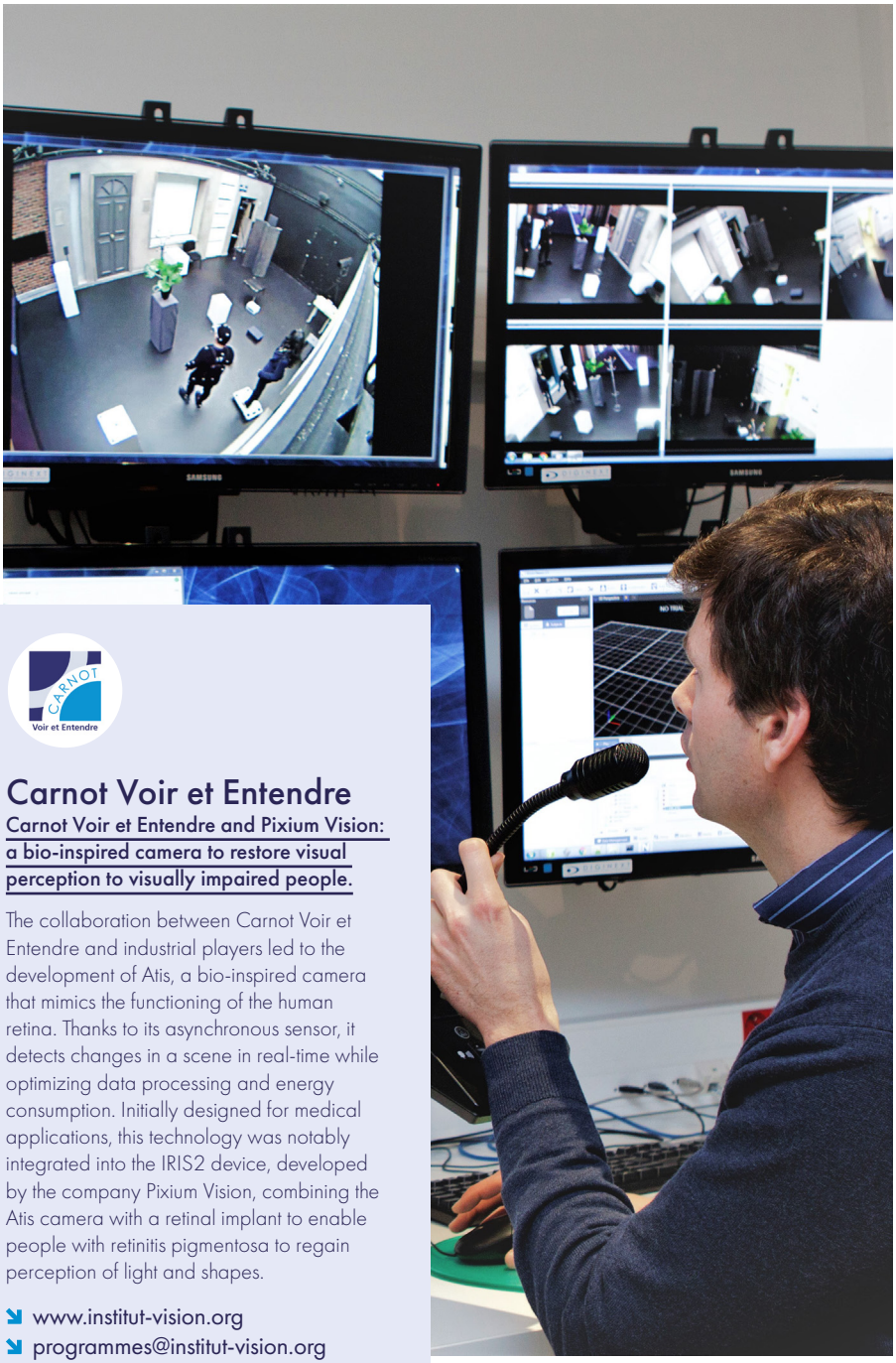


## Carnot Télécom et Société numérique

**A cutting-edge computing infrastructure serving research in artificial intelligence.**

For ten years, the Télécom Paris engineering school has had a large computing infrastructure, built notably with the support of Carnot TSN. A first-rate platform that allows the institution's research teams and students to train and test their AI models for free. Artificial intelligence represents an invaluable tool for many sectors, so much so that few are those today who do not rely on it. However, machine learning methods, such as machine learning or deep learning, require immense computing power. And this, even before their concrete use: the training phase, during which algorithms learn to solve the problem submitted to them, requires a huge amount of calculations.

- www.carnot-tsn.fr
- laurent.ebner@imt.fr



## Carnot Voir et Entendre

**Carnot Voir et Entendre and Pixium Vision: a bio-inspired camera to restore visual perception to visually impaired people.**

The collaboration between Carnot Voir et Entendre and industrial players led to the development of Atis, a bio-inspired camera that mimics the functioning of the human retina. Thanks to its asynchronous sensor, it detects changes in a scene in real-time while optimizing data processing and energy consumption. Initially designed for medical applications, this technology was notably integrated into the IRIS2 device, developed by the company Pixium Vision, combining the Atis camera with a retinal implant to enable people with retinitis pigmentosa to regain perception of light and shapes.

- www.institut-vision.org
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