



# Technologies CSIC 2026



The background of the entire page is a solid teal color. Overlaid on this are several sets of thin, dark teal lines that flow from the top left towards the bottom right. These lines are curved and parallel to each other, creating a sense of movement and depth. They appear to be part of a larger, continuous pattern that wraps around the edges of the page.

# Technologies CSIC 2026



## INTRODUCTION

The Spanish National Research Council (CSIC) is the largest public institution in Spain dedicated to scientific and technical research, and one of the most prominent in the European Research Area. Among its main goals is to bring its scientific and technological capacities and achievements closer to all national and international socio-economic sectors, with the aim of transforming them into social, economic, and cultural well-being for society as a whole.

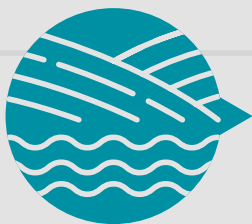
At CSIC, knowledge transfer is coordinated through the Vice-Presidency for Innovation and Knowledge Transfer, which includes a central office in Madrid, as well as a network of offices located within institutional delegations and several of CSIC's research institutes. This Vice-Presidency carries out, among other activities, the protection and promotion of research results and their transfer to the business sector, the management of collaborations between CSIC and companies, and the support for the creation of new knowledge-based companies that incorporate CSIC technologies.

This catalogue presents a selection of the most innovative and cutting-edge technologies developed at CSIC, which are available for licensing or for collaborative projects with companies that can support their development and market readiness.

If you are interested in any of the technologies presented here, please contact us by email, indicating the reference of the technology, at [comercializacion@csic.es](mailto:comercializacion@csic.es)

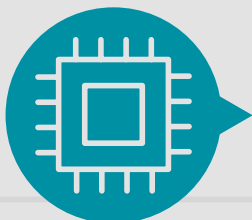


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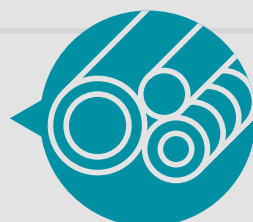
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**BIOTECHNOLOGY**



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# AGRICULTURE, LIVESTOCK AND MARINE SCIENCE



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## A NEW MOLECULAR SYSTEM FOR A HIGH-EFFICIENCY OF *IN VITRO* PLANT PROPAGATION

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/MB/018

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An efficient system that uses mammalian kinase inhibitors to promote the *in vitro* induction of embryogenesis and plant regeneration, with strong potential for large-scale application. The main advantage of *in vitro* plant propagation is the rapid production of large numbers of uniform, disease-free, and high-quality planting material for agro-industrial companies.



### APPLICATIONS AND BENEFITS

It promotes the induction and optimization of *in vitro* plant embryogenesis, both from somatic cells and from microspores of crop and forest plant species. It has strong potential for large-scale propagation and the cryopreservation of elite tree genotypes, as well as for transformation strategies. It has been successfully applied to different *in vitro* protocols, in both liquid and solid media, and with direct, indirect and secondary (recurrent) embryogenesis.

INSTITUTE: CIB

TRL

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## EUDESMANOLIDES AS BIOSTIMULANTS FOR MYCORRHIZAL COLONIZATION

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/VM/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Agriculture requires the massive use of chemical fertilizers and pesticides to maintain production levels, which has a huge environmental impact. An alternative is the use of eudesmanolides, naturally occurring compounds that act as stimulants and therefore improve the efficiency of arbuscular mycorrhizal fungi and mycorrhization in plants. The advantage of these substances is that they are harmless to the plant and work at very low doses.



### APPLICATIONS AND BENEFITS

The addition of biostimulants (prebiotics) such as eudesmanolides enhances the activity of arbuscular mycorrhizal fungi, which improve crop productivity and soil quality. Their efficacy has been demonstrated *in vitro* and *in vivo* in various cultivars, as well as under production conditions in tomato plants (proof of concept). Furthermore, these compounds can be used in conjunction with commercial products based on arbuscular mycorrhizal fungi.

INSTITUTE: EEZ

TRL

1 2 3 4 5 6 7 8 9

## FISHBIT: BEHAVIOR MONITORING OF FARMED FISH

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/IG/071

### DIFFERENTIAL VS OTHER TECHNOLOGIES



FishBIT is a small device that stands out for its ability to directly and continuously monitor the behaviour and welfare of farmed fish by measuring respiratory rate and physical activity. Its reusable and reprogrammable design, validated in sea bream, sea bass, salmon, and trout, allows for accurate assessments of metabolism and adaptation. Compared to traditional methods, it provides objective data to improve genetics, farming systems, and feed formulations, ensuring evidence-based decisions and production optimization.



### APPLICATIONS AND BENEFITS

FishBIT is used in aquaculture to evaluate pilot programs for genetic improvement, new farming systems, and functional feed formulations. By monitoring fish metabolism, behaviour, and adaptation, it allows for real-time detection of necessary adjustments, reducing production risks and improving efficiency. This translates into healthier crops, higher yields, compliance with animal welfare standards, and adaptability to environmental changes, strengthening the sector's profitability and sustainability.

INSTITUTE: IMB-CNM / IATS

TRL **1** 2 3 4 5 6 7 8 9

## SUSTAINABLE AND SAFE AGRICULTURAL BIOFUNGICIDES

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/ME/027

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The overproduction of antifungal proteins combined with the removal of antibiotic resistance markers positions our optimized strain of *Penicillium chrysogenum* as a safe and scalable biotechnological platform for the sustainable production of biofungicides. Compared to conventional chemical fungicides, these biofungicides provide high efficacy, straightforward extraction and purification, applicability for crop protection and during postharvest storage, and show no *in vitro* cytotoxicity in human cells.



### APPLICATIONS AND BENEFITS

The biofungicide produced by our *Penicillium chrysogenum* strain has demonstrated *in vivo* efficacy against green, blue, and gray molds, as well as rice blast disease. The robustness and scalability of the producing strain enable industrially viable production, with the potential to reduce annual economic losses by hundreds of millions of dollars while also decreasing food waste and its associated social impact.

INSTITUTE: IATA

TRL **1** 2 3 4 5 6 7 8 9

## A NEW VARIETY OF MUSTARD WITH HIGH CONTENT OF ANTHOCYANINS

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/078

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The Karuna variety of mustard has the distinctive characteristic of having a high content of anthocyanins in the leaves and stems of the plant throughout its vegetative cycle, while normal plants of this species do not have anthocyanins, which are bioactive compounds with health benefits.



### APPLICATIONS AND BENEFITS

Currently, there is a demand in the market for foods that are important for health due to their high content of bioactive compounds, such as the anthocyanins contained in the Karuna plant product.

INSTITUTE: IAS

TRL 1 2 3 4 5 6 7 8 9

## TWO NEW VARIETIES OF SWEDE

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/079

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Currently, there is a market demand for foods with a high content of bioactive compounds, nutrients and antioxidants, providing significant health benefits. Nabicord-3 and Nabicord-8 are two horticultural crops characteristic of southern Galicia and northern Portugal that contain bioactive compounds of great nutraceutical interest and could be incorporated in the Southern of Spain as locally sourced vegetables. Both the leaves and the pre-flowering stems (turnip greens) are consumed.



### APPLICATIONS AND BENEFITS

Incorporation of these crops into the Mediterranean diet, for the first time, as locally sourced vegetables. Both the leaves and the pre-flowering stems (turnip greens) are consumed.

INSTITUTE: IAS

TRL 1 2 3 4 5 6 7 8 9

## NEW VARIETY OF TURNIP TOP: TARDÍO (*Brassica Rapa L. var. rapa*)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AM/023

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The Tardío turnip green variety is a crossbreeding variety of nine local Galician turnip green varieties. It exhibits late flowering (more than five months after transplanting) and late turnip green production (four and a half months after transplanting) compared to typical cycles, resulting in a higher yield of turnip greens over a longer growing season and a greater overall yield of turnip greens.



### APPLICATIONS AND BENEFITS

Its harvest time is late, so it is available on the market for longer compared to other varieties. Its horticultural use includes leaves and shoots (turnip tops). It has great culinary interest and high nutritional value due to its high content of compounds beneficial to health such as antioxidants and glucosinolates.

INSTITUTE: MBG

TRL 1 2 3 4 5 6 7 8 9

## DRONE SENSOR FOR SOIL MOISTURE AND IRRIGATION EFFICIENCY

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/VC/039

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A highly precise radio wave drone-mounted sensor, capable of providing soil moisture measurements both at the surface (5 cm) and at depth (50 cm), with a pixel size of around 20 m and a coverage rate of 30 ha/h. This makes it a particularly useful tool for precision farming and sustainable water resource management.



### APPLICATIONS AND BENEFITS

Droughts require more accurate technologies to measure soil moisture. The solution uses a drone sensor that reaches a depth of 50 cm, with a resolution of 20 m and coverage of 30 ha/h. It provides reliable data on soil water status even in drought conditions. The data collected by this device enables more efficient use of irrigation water, the selection of the most suitable crop for each plot based on soil moisture at depth and the detection of leaks in water distribution networks.

INSTITUTE: ICE

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SUSTAINABLE BIOMASS OF HEDISTE DIVERSICOLOR AS A NATURAL SOURCE OF OMEGA-3

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/CJ/022

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Protocol optimised for the intensive and controlled cultivation of *Hediste diversicolor*, including sustainable production techniques with low environmental impact and efficient biomass harvesting for various aquaculture and biotechnology applications. The result is a raw material rich in omega-3 lipids, which is of great interest to the aquaculture and biotechnology sectors.



### APPLICATIONS AND BENEFITS

The system integrates production techniques with low environmental impact, high reproductive efficiency and water quality control, ensuring a stable process that can be transferred to productive environments. The biomass obtained is rich in omega-3 lipids, making it a high-value raw material for aquaculture. The species is also used as fishing bait and is suitable for integrated multitrophic aquaculture (IMTA) and circular economy projects.

INSTITUTE: IEO

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## NEW VARIETIES OF *Prunus* FRUIT TREES (APRICOT, ALMOND AND PLUM TREES)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/027

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Through traditional natural varietal improvement processes, new plant varieties of the *Prunus* genus have been obtained, which together exhibit a range of different organoleptic characteristics and different flowering and fruit ripening conditions that determine the production of abundant and high-quality harvests.



### APPLICATIONS AND BENEFITS

More than ten apricot varieties, four almond varieties, and two plum varieties new are available for cultivation and production. See the catalog at <http://cebasfruit.com>

INSTITUTE: CEBAS

TRL **1** 2 3 4 5 6 7 8 9

## NEW PLANT VARIETY OF CAROB (*Vicia articulata Hornem*)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/055

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Carob variety adapted to winter sowing in Mediterranean rainfed crops of medium size and erect growth. Taller (60-70 cm) and later (5-6 days) and with more biomass than other carob varieties.



### APPLICATIONS AND BENEFITS

Good production of both forage and grain. Very good performance in associated crops, for example with barley. Very good soil coverage with abundant biomass that prevents the development of weeds.

INSTITUTE: IAS

TRL 1 2 3 4 5 6 **7** 8 9

## NEW PLANT VARIETIES OF ALMORTA, TITARRO AND LUPIN (*Lathyrus spp.*)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/058

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Three new varieties of *Lathyrus* has been obtained from ten years of mass selection.



### APPLICATIONS AND BENEFITS

The interest of these varieties is their adaptation to various winter, dry planting conditions and being, in some of them, moderately resistant to jopo (*Orobanche crenata*) and very resistant to the ascochyta pest (*Mycosphaerella pinodes*).

INSTITUTE: IAS

TRL 1 2 3 4 5 6 **7** 8 9

## NEW LEGUME PLANT VARIETIES (*Medicago*)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AJ/071

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Scooter, Caliatá, and Carruco are varieties of legumes adapted to Mediterranean dry lands.



### APPLICATIONS AND BENEFITS

The cultivation of these new varieties is intended for forage. Very early flowering time in some of them.

INSTITUTE: IAS

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## GALICIAN NATIVE MAIZE VARIETY: CARBALLEIRA (*Zea mays* L.)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AM/013

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Native variety of corn recovered in the Pontevedra region and subjected to an improvement process intensifying its most distinctive characters: its dark-coloured grains and a greater presence of anthocyanins. The cultivation areas are focused on low altitude areas.



### APPLICATIONS AND BENEFITS

Very visually attractive variety due to the dark purple or black colour of its grains. It also has a high content of anthocyanins, which are attributed antioxidant properties that increase the value of the flour obtained, serving as a basis for obtaining varieties of great culinary interest. It has excellent quality, especially suitable for making bread.

INSTITUTE: MBG

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## NEW VARIETY OF PEA: BÁGOA ATLANTIC (*Vitis vinifera* L.)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AM/022

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Bágoa Atlantic is a pure line of pea obtained through individual selection within a local variety from Monfero (A Coruña) in 2013. It has indeterminate growth (medium branching), with good early vigour, great hardiness and low input requirements, adapted to production in horticultural areas. The grain is very small in size and, in the immature stage, it is tear-shaped. The yield in experimental cultivation is about 1000 kg/ha of immature grain.



### APPLICATIONS AND BENEFITS

Bágoa Atlantic has a high economic value in the market and is highly appreciated in haute cuisine due to its excellent sensory quality, based on the texture of the grain, its high content of water and soluble solids, which provides it with characteristics that make it considered "vegetable caviar".

INSTITUTE: MBG

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## A NEW PLANT VARIETY OF AMARANTH (*Amaranthus cruentus* L.)

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AM/021

### DIFFERENTIAL VS OTHER TECHNOLOGIES



New variety of amaranth obtained through intravarietal selection, called Amapop. The interest of this variety lies in its potential as a raw material to become an appetizer/snack after the heat expansion of the grain. There is no similar variety commercially. The peculiarity of this grain is that it expands with heat (110°C/30 seconds) and an increase in volume of 378%.



### APPLICATIONS AND BENEFITS

It is a highly nutritious product, recommended for vegans and vegetarians, due to its high-quality vegetable protein and suitable for people with celiac disease. The nutritional value of the grain, superior to that of cereal grains, is not lost during air expansion of the grain, and it becomes a product with a crunchy texture that can be used as a nutritious cereal or to give a touch of texture to yogurts and creams. Furthermore, due to its extrusion capacity, it can be transformed into an appropriate flour by itself, or to mix with flours from other sources, to obtain foods such as snacks, breakfast cereals, etc.

INSTITUTE: MBG

TRL **1** 2 3 4 5 6 **7** 8 9

## SIMZEBRA: A SOFTWARE FOR ZEBRA MUSSELS DETECTION IN PRESSURIZED NETWORKS

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/AP/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



SIMZEBRA offers a clear visualization of zebra mussels infestation levels through customizable maps, generated for user-defined time intervals. Operating remotely on a cloud server, SIMZEBRA makes it easy to use without the need for advanced local computing resources. Unlike other traditional methods, which require costly physical inspections and continuous manual analysis, SIMZEBRA automates the infestation detection process. It is an efficient, scalable and easy-to-implement tool.



### APPLICATIONS AND BENEFITS

It allows for early detection of infestations and in specific segments of the network. Its integration with telemetry systems could provide real-time updates on the status of the network. Enables the analysis of the effectiveness of chemical or mechanical treatments for zebra mussel control. It can model different levels of infestation and their consequences on the network to anticipate problems and optimize responses. Applicable to other invasive species.

INSTITUTE: EAD

TRL **1** 2 3 4 5 6 7 **8** 9

## ATTENUATED VARIANT OF THE RIFT VALLEY FEVER VIRUS

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/RR/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The main issue with vaccines based on live attenuated viruses is associated with the residual virulence of the formulations used. However, this virus variant could serve as the foundation for a new vaccine strain with improved safety parameters compared to those achieved so far.



### APPLICATIONS AND BENEFITS

This vaccine strain could provide an excellent basis for developing a successful immunization program in camels, cattle, goats, and sheep in affected countries or for implementing preventive control measures in countries at higher risk of disease introduction or spread.

INSTITUTE: INIA

TRL

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## PROCESS FOR BLOOD REVALORIZATION TO GENERATE AN ANIMAL FEED PRODUCT WITH HIGH ADDED VALUE

CATEGORY: AGRICULTURE, LIVESTOCK AND MARINE SCIENCE

TO: CSIC/ME/031

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most of the blood from slaughterhouses is a waste management problem for this type of industry. This residual blood contains a large amount of components of interest and, therefore, can be used as raw material to generate products with high added value. To revalue the blood, hydrolysis processes are used to obtain peptides and amino acids. Chemical hydrolysis is currently used, but this process is not sustainable. This new enzymatic hydrolysis process makes it possible to obtain peptides that can be used as animal food additives with very beneficial properties.



### APPLICATIONS AND BENEFITS

The peptides obtained by the new enzymatic hydrolysis method present characteristics that make them interesting to be used in animal feed, especially in the fish farming industry. They have been shown to promote growth rate, increase swimming performance and allow the prevention and/or treatment of stress and behavioural disorders of the subjects. Similarly, the bioactive peptides generated show antioxidant, anti-inflammatory, hypoglycaemic and immunomodulatory activity. Therefore, the new hydrolysate can be used in different food and pharmaceutical applications.

INSTITUTE: IATA/IATS

TRL

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# BIOTECHNOLOGY



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



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COMMUNICATION  
TECHNOLOGY

## GELPHYMAN: GELLING POLYSACCHARIDE FOR THE PRODUCTION OF THERMO-ADAPTATIVE HYDROGELS

CATEGORY: BIOTECHNOLOGY

TO: CSIC/PL/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Gelphyman is a natural bacterial polymer presented as a biodegradable alternative to replace synthetic polymers. It can reduce the use of chemical agents and energy consumption in the manufacturing processes of medical and cosmetic products, thereby increasing safety and reducing microplastic pollution.



### APPLICATIONS AND BENEFITS

Natural polymer provides greater biocompatibility and biodegradability than synthetic polymers and has high scalability potential for its production. It has the ability to gel on its own through temperature changes, without the need for added crosslinking substances, making it particularly attractive for biomedical and tissue engineering applications. It has been tested in DNA gels (as a substitute for agarose) and protein gels (as a substitute for acrylamide).

INSTITUTE: EEZ

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## PEPTIDE FOR IMPROVING THE CELLULAR DELIVERY OF BIOMOLECULES IN THE TREATMENT OF PANCREATIC DISEASES

CATEGORY: BIOTECHNOLOGY

TO: CSIC/MS/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Current systems for intracellular protein targeting, such as antibodies, are heavily limited by their molecular size and permeability. This granular-targeting peptide, composed of only seven amino acids, can direct biomolecules to zymogen granules located in the acinar cells of the exocrine pancreas, which are key determinants in the pathophysiology of pancreatitis, providing a far more precise and versatile targeting platform.



### APPLICATIONS AND BENEFITS

The peptide specifically delivers fused molecules to the granules, enabling their integration into ad-hoc designed proteins either by addition to the C-terminal end or by replacing protein-sorting domains. It can be incorporated into delivery platforms such as nanocarriers and liposomes, and is suitable for use in cell-based therapies for the treatment of pancreatic diseases.

INSTITUTE: ICM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## IMPROVEMENT OF PLANT GENETIC TRANSFORMATION USING PLANT VIRUSES

CATEGORY: BIOTECHNOLOGY

TO: CSIC/MB/037

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Current methods for delivering RNA sequences to plants and transforming them using plant viruses have numerous limitations, such as complex and labor-intensive procedures, as well as limited capacity to transport large sequences and restrictions on the type of the sequence that can be delivered. The methodology developed overcomes these limitations by inserting specific sequences into the genomes of the viruses used for transformation.



### APPLICATIONS AND BENEFITS

This method represents a major breakthrough in plant biotechnology, as it allows RNA sequences to be introduced into plants using plant viruses with greater flexibility than traditional methods. The modifications made avoid reading-frame restrictions, that is, the sequence to be delivered does not need to be cloned in-frame with the polyprotein coding sequence and can include non-coding sequences with potential stop codons.

INSTITUTE: CIB

TRL **1** 2 3 4 5 6 7 8 9

## GENE CONSTRUCTS FOR THE PRODUCTION OF HETEROLOGOUS PROTEINS OF INTEREST

CATEGORY: BIOTECHNOLOGY

TO: CSIC/RA/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The use of specific gene constructs that enable the expression and production of high concentrations of heterologous target proteins in filamentous fungi, tailored to the needs of industrial protein manufacturing. By cultivating cells into which these sequences have been introduced and increasing the pH of the culture medium, the expression and high-level production of the desired proteins or polypeptides are induced without the need for inducers that could cause significant alterations to cellular metabolism.



### APPLICATIONS AND BENEFITS

It is a fast method compatible with high ammonium levels, allowing the co-expression of two different proteins within the same host cell and the use of complex media based on low-cost carbon and nitrogen sources. Because expression is induced by increasing the pH, pellet formation is avoided, reducing the energy required to agitate the medium in the fermenter. It is therefore a revolutionary and cost-effective method.

INSTITUTE: CIB

TRL **1** 2 3 4 5 6 7 8 9

## NANOPARTICLES WITH A HYDROPHOBIC SUPPORT FOR DRUG DELIVERY

CATEGORY: BIOTECHNOLOGY

TO: CSIC/RA/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Soluble and insoluble nanoparticles composed of at least one polypeptide with affinity for a hydrophobic support, which binds to a protein of interest to provide combined biological functionality and enable targeted drug delivery, increasing effectiveness, reducing required dosage, and minimizing potential side effects.



### APPLICATIONS AND BENEFITS

This innovative system offers high versatility, overcoming the need for poorly soluble affinity polypeptides or chemically modified lipids. Its applicability ranges from the development of drug delivery systems encapsulated in liposomes or extracellular vesicles and directed to specific cell types, to the production of magnetic nanoparticles with diagnostic and/or therapeutic capabilities.

INSTITUTE: CIB

TRL

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## NEW CAS9 NUCLEASES WITH UNIQUE CHARACTERISTICS FOR CRISPR-CAS GENETIC EDITING

CATEGORY: BIOTECHNOLOGY

TO: CSIC/MS/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



CRISPR-Cas systems are widely used in genetic engineering to edit and modify DNA precisely. However, current Cas9 variants have some drawbacks, such as lack of precision (off-targets), risk of immunogenicity, or large size, which makes it difficult to introduce them into certain cells. Two new Cas9 nucleases (DO1 and DO2) have been identified, which show low similarity to any other described functional Cas9, as well as unique biophysical properties due to their marine microbial origin and deep-sea habitat.



### APPLICATIONS AND BENEFITS

These new Cas9 variants reduce the risk of immunogenicity, are thermosensitive, allowing them to be denatured at temperatures  $>30^{\circ}\text{C}$ , and show higher specificity than the gold standard (SpCas9). Additionally, DO1 is a smaller protein that exhibits catalytic activity at low temperatures, while DO2 allows editing of the same sequence as the gold standard in case of immune reactions to it. All of this has been tested in *C. elegans* and in certain plant organisms.

INSTITUTE: ICM

TRL

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## GLUTEN DEGRADING PROTEIN FOR THE PREVENTION OF CELIAC DISEASE

CATEGORY: BIOTECHNOLOGY

TO: CSIC/XA/013

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Coeliac disease is caused by partially degraded gluten peptides that trigger a pro-inflammatory autoimmune response. A recombinant protein, derived from a naturally occurring one, has been developed, which is able to degrade these immunogenic peptides, thus preventing or reducing the inflammatory response. This protein remains stable and active in the strongly acidic gastric environment and resists digestive enzymes, as well as being stable under ambient conditions.



### APPLICATIONS AND BENEFITS

This protein may have applications as a food supplement as well as in the food industry for the manufacture of gluten-free products. In gliadin degradation assays in an animal model of coeliac disease, it performed significantly better in terms of reducing the amount of toxic peptide, even at low doses, compared to another endopeptidase with glutenase activity.

INSTITUTE: IBMB

TRL

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## PROCESS FOR BLOOD REVALORIZATION TO GENERATE AN ANIMAL FEED PRODUCT WITH HIGH ADDED VALUE

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TO: CSIC/ME/031

### DIFFERENTIAL VS OTHER TECHNOLOGIES



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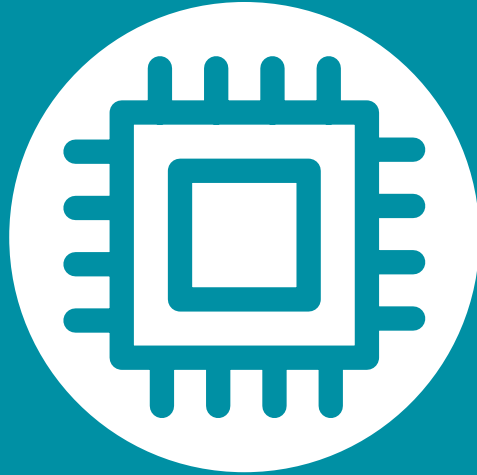
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INSTITUTE: IATA/IATS

TRL

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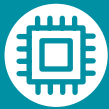
# ELECTRONICS



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## HIGH-SPEED RADON DETECTION SYSTEM

CATEGORY: ELECTRONICS

TO: CSIC/IG/118

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The radon sensor developed stands out for its ability to provide real response times in minutes, thanks to the joint analysis of  $^{218}\text{Po}$  and  $^{214}\text{Po}$  decays, which allows for reliable measurements without waiting for secular equilibrium. In addition, it incorporates energy discrimination to separate radon and thoron in real time, avoiding false positives and surpassing the reliability of cheap sensors or the slowness and cost of current professional equipment.



### APPLICATIONS AND BENEFITS

The technology responds to the growing need to monitor radon in old buildings, underground spaces, and areas with limited ventilation, where prolonged exposure poses serious health risks. Its speed, accuracy, and ability to differentiate isotopes enable more reliable control, facilitating on-demand ventilation decisions and remote monitoring via IoT. All this offers an accessible, robust, and suitable solution for improving air quality.

INSTITUTE: IMB-CNM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## ADVANCED SOLUTION FOR THERMAL CONTROL IN PRECISION METROLOGY ENVIRONMENTS

CATEGORY: ELECTRONICS

TO: CSIC/VC/040

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Temperature measurement electronics system capable of achieving local thermal stability with fluctuations on the order of  $\mu\text{K}/\sqrt{\text{Hz}}$  in the millihertz range. It minimizes ambient temperature noise and drift in optical and quantum components, ensuring greater stability in monitoring temperature fluctuations compared to the state of the art.



### APPLICATIONS AND BENEFITS

This measurement electronic system is versatile, ideal for use with optical cavities, interferometric AFMs, atomic clocks, quantum sensors, reference metrology and ultra-precision applications. Compatible with vacuum and cryogenic technologies, and It is scalable to commercial applications such as compact thermal stabilization modules for ultra-stable lasers.

INSTITUTE: ICE

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGH-PRECISION DATA ACQUISITION AND CONTROL: A SCALABLE MODULAR PLATFORM

CATEGORY: ELECTRONICS

TO: CSIC/JG/009

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The modular acquisition system redefines data control with its unique architecture interconnected via fibre optics, enabling analogue speeds of up to 1 GSPS, complete control stability and high scalability. Its robust and reliable design ensures efficient and precise operation, even in demanding environments.



### APPLICATIONS AND BENEFITS

This technological solution offers real sub-nanosecond synchronization and total scalability, allowing for the addition of nodes without temporal degradation. Thanks to its long-distance fibre optic networks (>100 km) featuring oscillator redundancy, it guarantees absolute reliability and prevents failure without loss of coherence. The system integrates intelligent thermal control to ensure operational stability and a modular architecture that is highly adaptable to various industrial and scientific applications.

INSTITUTE: IFIC

TRL **1** 2 3 4 5 6 7 8 9

## REMAINING LIFE PREDICTION SYSTEM FOR ELECTRONIC COMPONENTS

CATEGORY: ELECTRONICS

TO: CSIC/MC/117

### DIFFERENTIAL VS OTHER TECHNOLOGIES



TRANSRUL is a system based on a hybrid artificial intelligence architecture for the accurate and reliable prediction of the remaining lifespan of critical electronic components such as transistors, capacitors, drive systems and regulators. The system uses a reduced set of measurable variables to generate forecasts with an accuracy of over 98%. Its design incorporates adaptive mechanisms for decision-making through alerts by criticality levels (green, yellow, red).



### APPLICATIONS AND BENEFITS

The procedure has been validated to ensure robustness against noise, adversarial disturbances, and variations in operating conditions. It represents an advance over existing solutions by combining accuracy, interpretability, and practical applicability. It has a direct application in industrial sectors such as advanced manufacturing, transportation, robotics, and energy.

INSTITUTE: CAR

TRL **1** 2 3 4 5 6 7 8 9

## NOVEL METHOD FOR TRANSDUCING MECHANICAL RESONANCES OF ANALYTES

CATEGORY: ELECTRONICS

TO: CSIC/MC/115

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Method that allows the detection of mechanical resonances of microbiological entities as small as bacteria and viruses. It uses a detector that has hundreds of detectable mechanical resonances in the same range as the analytes. The main advantage is its ability to detect vibrations from individual analytes and, unlike other methods, it does not require the mechanical resonances of the analyte to be coupled with the sensor.



### APPLICATIONS AND BENEFITS

The mechanical spectrum of these microbiological entities can provide a unique mechanical fingerprint that allows them to be identified unequivocally. It would have applications in the diagnosis of infectious diseases, detection and identification of pathogens in the environment, and development of new drugs.

INSTITUTE: IMN-CNM

TRL **1** 2 3 4 5 6 7 8 9

## ADVANCED SOFTWARE FOR NOISE AND TILT CORRECTION IN 3D IMAGING

CATEGORY: ELECTRONICS

TO: CSIC/AI/008

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Software for the removal of distortions related to both tilt and stochastic noise in 3D imaging, significantly increasing accuracy in digital microscopy. It enables the quantification of nanometric fluctuations in biological systems and materials, reaching detail levels not achievable with conventional methods.



### APPLICATIONS AND BENEFITS

It incorporates a correction algorithm that uses internal image references to identify, quantify, and suppress tilt and stochastic noise at the pixel level. The technology has been validated in digital holographic microscopy, enabling measurement of intracellular fluctuations that were previously inaccessible. The method is adaptable to other imaging modalities requiring stabilization or common-noise suppression.

INSTITUTE: IMN-CNM

TRL **1** 2 3 4 5 6 7 8 9

## METHOD FOR MANUFACTURING SILICON THAT DETECTS INFRARED LIGHT AT ROOM TEMPERATURE

CATEGORY: ELECTRONICS

TO: CSIC/AI/013

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A new method to fabricate silicon with a cone-shaped microstructured surface using femtosecond lasers in air. After controlled heat treatment and mild chemical etching, a crystalline, defect-free surface is obtained. Impurities are then introduced onto this surface via ion implantation using a rotating system and activated with a nanosecond laser.



### APPLICATIONS AND BENEFITS

A silicon with hyperdoped microstructures is obtained. It acquires the ability to absorb and detect infrared light at room temperature without the need for cooling and compatible with the current microelectronics industry,

INSTITUTE: IO

TRL **1** 2 3 4 5 6 7 8 9

## ANTI-COUNTERFEITING INKS WITH INTEGRATED MICROCHIPS

CATEGORY: ELECTRONICS

TO: CSIC/IG/169

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A unique authentication approach based on fully customizable microchips that can be integrated into almost any type of ink, from standard commercial formulations to high-security coatings. Unlike current solutions relying on optical effects or chemical markers—which can be replicated with advanced imaging and printing tools—these microchips provide unclonable identifiers while remaining compatible with existing industrial printing processes, offering a superior level of protection.



### APPLICATIONS AND BENEFITS

Inks with embedded microchips enable the authentication of documents, packaging and products through unique optically readable information, delivering true item-level traceability. Their easy incorporation into commercial inks and industrial coatings supports sectors needing strong protection against increasingly sophisticated counterfeiting. The solution enhances security without altering printing workflows, reduces risk, and improves control across high-value and sensitive industries.

INSTITUTE: IMB-CNM

TRL **1** 2 3 4 5 6 7 8 9

## DESIGN OF AN ENRICHED ACOUSTIC ENVIRONMENT AS PERSONALISED SOUND THERAPY FOR TINNITUS

CATEGORY: ELECTRONICS

TO: CSIC/MC/114

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Tinnitus is an incurable hearing disorder that can cause unpleasant and even severe effects. A personalised sound treatment called Enriched Acoustic Environment (EAE) has been developed, which can be adapted to each patient's hearing loss based on audiometric tests for each ear. It consists of exposing the patient to a combination of continuous and sequential sound stimuli for one hour a day over a period of four months. For the design of these EAE stimuli, an application and a graphical user interface have been developed, which allows for personalized application in the patient's own home.



### APPLICATIONS AND BENEFITS

This sound therapy has been tested on more than 800 tinnitus patients, with 86% of those who complete the treatment experiencing a significant improvement and reduction in their emotional symptoms. Furthermore, the equalized listening to these stimuli for one hour a day compensates for the hearing loss caused by tinnitus, and due to neuroplasticity, its effects are expected to diminish over the course of the treatment.

INSTITUTE: ITEFI

TRL **1** 2 3 4 5 6 7 8 9

## DEVICE FOR SIMULTANEOUS ACQUISITION OF AUTO-EXPOSURE AND HIGH DYNAMIC RANGE IMAGES IN A SINGLE SHOT

CATEGORY: ELECTRONICS

TO: CSIC/ER/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



First imaging technology that integrates high dynamic range (HDR) and auto-exposure (AE) into a single image shot, while maintaining a linear sensor response. Hardware implementation based on pixel array circuitry, which automatically adjusts its response to ambient illumination and the radiance map to the available signal range. It features asynchronous circuit operation, with no need for external control.



### APPLICATIONS AND BENEFITS

It achieves a simple, fast and autonomous imaging process without making assumptions about scene lighting conditions. It saves system memory and resources by not requiring multiple images or additional post-processing. Ideal for applications that require fast decision making, such as drone navigation, security, etc.

INSTITUTE: IMSE-CNM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## CYBERSECURITY METHOD THAT GENERATES UNCLONABLE PHYSICAL FUNCTIONS (PUFs) USING ACOUSTO-OPTICAL SYSTEMS

CATEGORY: ELECTRONICS

TO: CSIC/ER/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The method generates a high number of challenge-response pairs and allows acousto-optical systems to be concatenated to increase their number, enabling strong PUFs. It reduces the complexity of acousto-optical systems, increasing reliability and enabling integrability and miniaturisation.



### APPLICATIONS AND BENEFITS

The PUF system generates a unique, stable and hard-to-predict response to each challenge, input to the system. It enables physical circuits to be given a digital identity. The high number of challenge-response pairs increases the complexity of the method and therefore the security against cybersecurity attacks. The method allows miniaturisation as a photonic integrated circuit (PIC) and integration into IoT devices.

INSTITUTE: IMSE-CNM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## DYNAMIC VISION SENSOR (DVS) FOR ADVANCED SURVEILLANCE AND TRACKING

CATEGORY: ELECTRONICS

TO: CSIC/ER/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



DVS device enabling foveation. It processes multiple resolutions simultaneously, the complete image in low resolution and the fovea regions in high resolution. It allows the movement and adjustment of the fovea regions to focus on the areas of interest. It has a fast response time of less than microseconds.



### APPLICATIONS AND BENEFITS

The DVS device is continuously active, unlike image sensors that operate at a certain frequency. The method allows foveation to be applied to these sensors. Overall it is a vision sensor with simultaneous high-speed motion detection and energy efficiency. Ideal for applications in autonomous vehicles, robotics and advanced surveillance systems.

INSTITUTE: IMSE-CNM

TRL

1 2 3 4 5 6 7 8 9

## STOCHASTIC VERTICALLY EMITTING LASER FOR SIGNAL PROCESSING AND HIGH-PRECISION ILLUMINATION

CATEGORY: ELECTRONICS

TO: CSIC/LR/026

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Conventional lasers, both edge-emitting and vertical cavity surface-emitting, exhibit high spatial coherence, which produces artefacts when illuminating a scene. For applications such as microscopy lighting, it is essential that lasers be diffuse cavity lasers, which have very low spatial coherence. This technology takes advantage of the discovery that diffusing surfaces enable resonant optical cavities and eliminate the need for traditional mirrors in laser manufacturing.



### APPLICATIONS AND BENEFITS

Semiconductor lasers are developed with a conventional epitaxial structure, while the optical cavity is defined by etching holes or slots in the die. This design simultaneously enables optical feedback within the cavity and vertical light extraction. The new device is proposed as a future platform for photonics-based neural networks, due to its scalable number of input and output nodes.

INSTITUTE: ICMN

TRL

1 2 3 4 5 6 7 8 9

## DEVICE FOR DIRECT DEPOSITION BY VACUUM SUBLIMATION

CATEGORY: ELECTRONICS

TO: CSIC/AF/012

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The sublimator allows direct deposition on the final surface of any substrate using a simple process without the need of ultra-high vacuum. The distance between the substrate and the sample to be sublimated can be modified for a better control of the process variables.



### APPLICATIONS AND BENEFITS

Applicable to a large number of surfaces of different natures, dimensions and functions. It can be used in standard R&D laboratories, without special environmental conditions.

INSTITUTE: ICMA B

TRL 1 2 3 4 5 6 7 8 9

## ELECTRONIC POINT-OF-CARE BIOSENSOR FOR FAST AND EASY DETECTION OF BIOMARKERS IN LIQUID BIOLOGICAL SAMPLES

CATEGORY: ELECTRONICS

TO: CSIC/AF/023

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Current sensors that allow *in situ* the detection of biomarkers molecules for diagnostic purposes require previously labelling of the molecule and only allow qualitative measurements. Our sensor allows label-free quantitative detection of biomarkers. This is achieved by combining an absorbent material that transports the sample to be analysed and sensor media that produce a variable electric current depending on the amount of analyte present in the sample.



### APPLICATIONS AND BENEFITS

This electronic device enables rapid on-site detection of disease biomarkers in liquid samples without the need for specialised personnel or complex procedures. Results are read by use of a potentiostat that can be connected to a mobile phone. Tested, for example, in saliva samples for the detection of hepatitis B virus.

INSTITUTE: ICMA B

TRL 1 2 3 4 5 6 7 8 9



# ENERGY



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## CATALYST FOR UPGRADING FISCHER-TROPSCH HYDROCARBONS INTO DROP-IN FUELS

CATEGORY: ENERGY

TO: CSIC/JB/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A bifunctional catalyst prepared by sequential impregnation that uses herringbone carbon nanofibers (CNF) as a support for platinum nanoparticles and metal oxides. This design enhances hydroisomerization and hydrocracking activity, especially when processing waxes in the Fischer-Tropsch process, thanks to the formation of nanometric "catalytic islands," resulting in biofuels with higher yields and better properties than conventional catalysts.



### APPLICATIONS AND BENEFITS

This type of catalysts, supported on carbon nanofiber (CNF) and hybridized with metal oxides, enables the production of an optimized biofuel during the hydroisomerization and hydrocracking stages of Fischer-Tropsch waxes. The improvements achieved in these process stages are primarily due to the less acidic nature of the carbon nanofiber supports compared to other conventional supports. The resulting biofuel, teste at a pilot scale, is suitable for aviation and maritime transport.

INSTITUTE: ICB

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## INSTANT PRODUCTION OF SOLID SULFIDE ELECTROLYTES FOR SOLID-STATE BATTERIES

CATEGORY: ENERGY

TO: CSIC/NG/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



We propose a stable, shelf-ready liquid-phase thiophosphate precursor that enables instant, room-temperature synthesis of sulphide solid electrolytes on demand. The precursor maintains chemical stability during storage but converts rapidly and quantitatively upon activation, ensuring precise stoichiometry and uniform mixing. This approach eliminates high-temperature processing and long milling steps. Also, it reduces energy consumption, processing time, and batch variability. The result is a scalable, reproducible feedstock suitable for continuous and industrial solid-state battery manufacturing.



### APPLICATIONS AND BENEFITS

The use of this liquid precursor avoids traditional high-temperature electrolyte processing and long milling steps. It also reduces energy consumption, processing time and batch variability. The result is a universal, scalable and reproducible raw material, which represents a significant advance in the industrial manufacturing of solid-state batteries for large-scale energy storage, whether in electric vehicle applications or grid energy storage.

INSTITUTE: ICV

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGH-PERFORMANCE AND SUSTAINABLE “MEA” TECHNOLOGY FOR ELECTROLYSIS AIMED AT GREEN HYDROGEN PRODUCTION

CATEGORY: ENERGY

TO: CSIC/MO/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Membrane-electrode assembly (MEA) technology incorporates an innovative architecture that integrates catalysts through a single-step vapor-phase deposition process, completely eliminating the use of ionomers and solvents. Unlike conventional MEAs based on catalytic inks, this technology enhances efficiency, stability, and reproducibility, while also reducing catalyst loading and minimizing environmental impact. It is furthermore fully compatible with industrial scaling for both acidic and alkaline electrolysis.



### APPLICATIONS AND BENEFITS

Designed for integration into electrolyzer stacks intended for green hydrogen production, these MEAs deliver high electrochemical performance, reduced active material consumption, and enhanced operational stability. They are compatible with industrial processes and with electrolysis in both acidic and alkaline environments. The technology has been validated in laboratory and relevant settings (TRL 4/5), demonstrating its technical viability and scalability potential.

INSTITUTE: ICMS

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGHLY SELECTIVE CATALYST FOR CONVERTING CAPTURED CO<sub>2</sub> INTO CO

CATEGORY: ENERGY

TO: CSIC/MC/112

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The incorporation of Cs and In into nickel-ceria catalysts increases oxygen mobility, basicity, and metal dispersion, resulting in higher CO<sub>2</sub> conversion and CO selectivity in the Reverse Water-Gas Shift (RWGS) reaction. Compared with other technologies, these catalysts exhibit a high dispersion of active phases, superior high-temperature stability, and higher productivity per unit mass of catalyst, reducing costs and supporting a circular-economy approach.



### APPLICATIONS AND BENEFITS

The catalyst stands out for its high efficiency in the RWGS reaction. This reaction is essential for converting captured CO<sub>2</sub> into CO, a key intermediate for producing synthetic fuels and chemicals such as methanol, Fischer-Tropsch hydrocarbons, and oxoalcohols. Thanks to its strong performance, the catalyst supports industrial decarbonization by helping to “close the carbon loop” when used together with renewable hydrogen, turning emissions into valuable resources.

INSTITUTE: ICP

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## COMPACT AND VERSATILE ELECTROCHEMICAL DEVICE FOR FLOW CELLS, FUEL CELLS OR HYDROGEN ELECTROLYSER

CATEGORY: ENERGY

TO: CSIC/AF/025

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A compact electrochemical device comprising fewer components than conventional systems, simplifying the assembly process and significantly reducing the risk of leaks. Its compact design requires lower applied pressure, resulting in a reduction in both volume and weight.



### APPLICATIONS AND BENEFITS

A highly versatile device that can be used as a flow cell, fuel cell or hydrogen electrolyser. It is particularly well suited to applications where leak prevention is critical or where frequent assembly and disassembly are required. Its reduced size facilitates use in portable applications.

INSTITUTE: ICMAB

TRL **1** 2 3 4 5 6 7 8 9

## PERMANENT CARBON SEQUESTRATION SYSTEM BASED ON ELECTROCHEMICAL CO<sub>2</sub> DECOMPOSITION TECHNOLOGY

CATEGORY: ENERGY

TO: CSIC/CF/058

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Carbon Capture, storage and use (CCUS) technology can mitigate CO<sub>2</sub> emissions by capturing CO<sub>2</sub> from fossil fuel power plants and industries and storing it underground. However, it faces high costs, uncertain storage capacity, safety risks and public opposition. Alternatively, the proposed system transforms CO<sub>2</sub> into solid carbon and oxygen. Oxygen can be used as a high-purity reagent or released into the environment, while carbon can be permanently stored or used for the manufacturing of high-value-added products.



### APPLICATIONS AND BENEFITS

Energy-efficient electrochemical CO<sub>2</sub> transformation process, with a transformation of more than 75% of the absorbed CO<sub>2</sub> into oxygen and carbon, highly intensive, involving a single step and can be interrupted or restarted whenever necessary depending on CO<sub>2</sub> production or renewable energy availability. The system is modular and scalable, making it adaptable to various industries, environments and energy sources, ensuring flexibility and efficiency in a variety of applications.

INSTITUTE: ITO

TRL **1** 2 3 4 5 6 7 8 9

## MAGNETIC FERRITE PERMANENT MAGNETS AS A SUSTAINABLE ALTERNATIVE TO RARE-EARTH BASED MAGNETS

CATEGORY: ENERGY

TO: CSIC/MC/092

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Permanent magnets make possible to store, supply and convert electrical energy into mechanical energy and vice versa. The most competitive ones are based on rare earths. The permanent magnets developed are obtained by sintering magnetic ferrite particles and an organic solvent. The process is simple and economical, with temperatures around 10% lower than commonly used, resulting in energy savings of more than 40%.



### APPLICATIONS AND BENEFITS

The main applications of these magnets are in the renewable energy generation, storage sector (e.g. wind turbines and flywheels), aeronautics and automotive sector (magnets for alternators and motors for electric or hybrid vehicles).

INSTITUTE: ICV

TRL

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## EFFICIENT HYDROGEN PRODUCTION BY ELECTROLYSIS WITH LOW ENERGY CONSUMPTION

CATEGORY: ENERGY

TO: CSIC/ME/015

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Advanced system for the generation of hydrogen through electrolysis that, using a pioneering electrode configuration, maximizes the concentration of the electric field in specific areas of interest to enhance the dissociation of the electrolyte, thus optimizing the efficiency of the reaction and decreasing both the voltage required and the energy consumption during the process. In addition, smaller and/or thinner electrodes are used without this representing a drawback for their robustness or mechanical resistance.



### APPLICATIONS AND BENEFITS

Electrohydrolysis of water is currently the most widely used method for the production of hydrogen, which can be used as a clean fuel without CO<sub>2</sub> emissions. This system's electrode arrangement improves the efficiency of the reaction, thus minimizing the energy cost. In addition, the system offers the flexibility to allow various electrode configurations, adapted to the particular needs of each situation.

INSTITUTE: I3M

TRL

1 2 3 4 5 6 7 8 9

## ULTRA-FAST PRODUCTION OF FLEXIBLE SUPERCONDUCTING TAPES

CATEGORY: ENERGY

TO: CSIC/AF/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Superconducting materials transport electricity without energy losses if they are below a critical temperature. This new method based on TLAG-CSD (Transient Liquid Assisted Growth Chemical Solution Deposition) allows them to be synthesized by improving the structural homogeneity of the superconducting layer, is 100 times faster than the methods currently used and has the characteristics to be considered green chemistry.



### APPLICATIONS AND BENEFITS

The method is ideal for the production of flexible superconducting tapes for magnetic resonance imaging equipment, particle accelerators, nuclear fusion reactors, etc.

INSTITUTE: ICMA B

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## NEW HIGH-PERFORMANCE CATALYST FOR H<sub>2</sub> PRODUCTION BY GLYCEROL VAPOUR REFORMING

CATEGORY: ENERGY

TO: CSIC/JB/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most commercial nickel catalysts supported on CeO<sub>2</sub> and MgO for H<sub>2</sub> production generate methane during glycerol steam reforming, reducing the efficiency of the process. In addition, they lack stability at 900°C, the key temperature for multi-cycle reforming, the most efficient way to produce hydrogen. The new catalyst stands out for its high performance in multi-cycle reforming processes, withstanding high temperatures and avoiding the formation of by-products. This facilitates industrial catalytic reforming and optimises mass hydrogen production.



### APPLICATIONS AND BENEFITS

This highly efficient catalyst is distinguished by its high performance in multi-cycle reforming processes, enhancing the mass production of hydrogen, a key factor towards renewable energies. The MgO-Al<sub>2</sub>O<sub>3</sub> or MgO-Al<sub>2</sub>O<sub>3</sub>-CeO<sub>2</sub> mixed oxide supports used have a specific surface area of at least 45 m<sup>2</sup>/g, which can be increased by high-temperature treatment.

INSTITUTE: ICB

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## RECOVERY OF LITHIUM FROM USED BATTERIES BY HYDROLYSIS AT TEMPERATURES BELOW 600°C

CATEGORY: ENERGY

TO: CSIC/MC/110

### DIFFERENTIAL VS OTHER TECHNOLOGIES



From the used lithium ion battery waste the “black mass” is obtained. This fraction contains the components of greatest interest. Many technologies have been developed to extract the lithium from the black mass, using either high temperatures or strong reagents such as acids.



### APPLICATIONS AND BENEFITS

The developed technology allows a simple recovery of lithium from the degradation of the electrolytes of depleted lithium ion batteries by hydrolysis, at milder temperatures below 600°C, and using water as the only reagent. It does not require purification steps or reprocessing of lithium salts. The recovered lithium can be subsequently used for the manufacture of new electrolytes or to be integrated in the manufacture of new batteries.

INSTITUTE: CENIM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## OPTOFLUIDIC MICROREACTOR FOR PHOTODEGRADATION OF ORGANIC AQUEOUS POLLUTANTS

CATEGORY: ENERGY

TO: CSIC/PT/070

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An optofluidic threaded microreactor (OTM) consisting of a externally threaded element (ETE) covered with a suitable catalytic material. It has an improved design compared with helical capillary microreactors with optimal use of reactor space and high surface-to-volume ratio maximizing aqueous pollution photodegradation. It has also a better performance than expensive chip-type microreactors.



### APPLICATIONS AND BENEFITS

It operates efficiently in the degradation of contaminants in water. It has been successfully tested in the photodegradation of ibuprofen under low-power UVA radiation, exhibiting very high and stable catalytic activity during long-term experiments in flow mode operation.

INSTITUTE: INCAR

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**



# HUMANITIES AND SOCIAL SCIENCES



AGRICULTURE, LIVESTOCK  
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TECHNOLOGY

## DIGITAL LANDSCAPES

CATEGORY: HUMANITIES AND SOCIAL SCIENCES

TO: CSIC/CS/009

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Analysis and management of cultural landscapes through the digital modeling of their variables. By integrating technologies such as remote sensing, geophysics, 3D virtualization, geomatics tools and spatial analysis, we address complex challenges in archaeological landscapes such as structures detection, implementation of information systems, monitoring to advanced 3D virtualization, etc. Our innovation lies in the specialized integration of a wide range of digital technologies, designing proprietary methodologies, aimed on solving inherent problems of cultural landscapes management, within the framework of archaeology and cultural heritage.



### APPLICATIONS AND BENEFITS

Provision to public and private institutions of comprehensive digital solutions based on digital tools for the study and stewardship of cultural landscapes within the framework of archaeology and cultural heritage. The designed methodologies have been key to obtaining deeper knowledge and improving the management of archaeological sites and cultural landscapes. These methods have made it possible to discover unknown heritage elements; expand site protection boundaries; track environmental changes in the landscape; analyze, disseminate and manage heritage through its digital virtualization, etc. By enhancing traditional workflows with our digital-first approach, we significantly optimize both time and operational costs while providing deeper analytical insights.

INSTITUTE: INCIPIT

TRL



## BIOGEOPAL LABORATORY

CATEGORY: HUMANITIES AND SOCIAL SCIENCES

TO: CSIC/CS/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The BioGeoPal laboratory provides a unique framework for studying socio-economic systems from prehistory to the present day. By integrating archaeobotanical and geoarchaeological techniques, the laboratory investigates aspects related to markers of human activity, evidence of environmental anthropization, and the acquisition and use of plant and fecal resources, with particular attention to food production, preparation, and consumption.



### APPLICATIONS AND BENEFITS

The research conducted at the BioGeoPal laboratory has implications for the understanding and preservation of intangible cultural heritage (such as food production and preparation) as well as cultural and gastronomic identities. Additionally, it enables the study of the resilience of agri-food systems and the management of natural resources—crucial aspects in the current context of climate change.

INSTITUTE: IMF

TRL



## CSIC TRADITIONAL MUSIC ARCHIVE

CATEGORY: HUMANITIES AND SOCIAL SCIENCES

TO: CSIC/CS/006

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The open-access digital platform FMT, with almost 50,000 items, is the most important online archive of oral tradition music in the Spanish-speaking world. It is the first Spanish website to include online music notation encoding and has been selected as a digital resource by Harvard and Stanford universities.



### APPLICATIONS AND BENEFITS

FMT makes intangible oral tradition heritage—at risk of disappearing—available to the public, offering immense musical, literary, educational, and social value. The melodies and texts collected throughout the 20th century are linked to the individuals who performed them and the locations where they were recorded. Additionally, FMT contributes to the development of cutting-edge digital technology, attracting research residencies and fostering social impact and knowledge transfer.

<https://www.musicatradicional.eu/>

INSTITUTE: IMF

TRL

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## SPECIALIZED SURVEY SYSTEM

CATEGORY: HUMANITIES AND SOCIAL SCIENCES

TO: CSIC/CS/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A proprietary software has been developed, adaptable to the specific needs of each study, ensuring that respondents provide comprehensive information. The software allows extensive control over both the distribution and completion of the questionnaire, maximizing the study's representativeness while enabling the quick detection and correction of errors.



### APPLICATIONS AND BENEFITS

A specialized service is offered for the full development of online surveys for identified populations. This involves programming and distributing a survey to selected individuals within the sample while dissociating the provided data from their identity. The system ensures the highest possible response rate, preserves respondents' anonymity, and maximizes both response quality and sample representativeness, all while ensuring an optimal survey-taking experience for participants.

INSTITUTE: IESA

TRL

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## ARCHAEOBOTANY LABORATORY

CATEGORY: HUMANITIES AND SOCIAL SCIENCES

TO: CSIC/CS/008

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A comprehensive analysis service for the characterization of fragile plant macro-remains, along with expert consultation for archaeological interventions. As an innovation, the analysis includes not only charred remains but also waterlogged and mineralized wood, as well as fiber analysis, including those preserved as imprints on other materials. Also innovative is the examination of manufactured items made from plant materials and the development of prototypes based on archaeological models for educational, exhibition, or commercial purposes.



### APPLICATIONS AND BENEFITS

Consulting, analysis, and morpho-technological studies of wood, fibers, and related manufactured objects are offered. Our goal is to transfer archaeobotanical research to the productive sector, public institutions, museum professionals, research centers, archaeological enterprises, and artisan communities—providing them with value-added prototypes while enhancing the understanding, exhibition, and dissemination of these archaeological materials and promoting craftsmanship.

INSTITUTE: INCIPIT

TRL

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# MATERIALS



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## SUSTAINABLE ADVANCED TECHNICAL PAPER FOR ARTISTIC AND INDUSTRIAL PRINTING

CATEGORY: MATERIALS

TO: CSIC/LR/023

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Conventional papers have low durability and require pretreatments that increase process costs and water consumption. Therefore, there is a need to develop a more resistant, versatile and sustainable substrate that simplifies production without compromising the final quality. The material developed, manufactured from recycled plant fibers such as eucalyptus and linen, and reinforced with natural additives (a nanocomposite based on fibrous clays and polysaccharides), eliminates the need for pre-wetting.



### APPLICATIONS AND BENEFITS

The formulation of this paper eliminates the need for pre-wetting, reducing production stages and water consumption. With a weight of over 200 g/m<sup>2</sup>, it can withstand up to 5 tons of pressure. It is compatible with water-based and oil-based inks and can incorporate preservation coatings (ISO 9706). Ideal alternative to current premium papers, with great potential for industrial transfer. It has high mechanical strength and tensile resistance, and it is applicable to multiple sectors such as art, publishing, packaging, and decoration industries.

INSTITUTE: ICMIM

TRL **1** 2 3 4 5 6 7 8 9

## METALLIC NANOPARTICLES WITH HIGH ELECTRICAL CONDUCTIVITY

CATEGORY: MATERIALS

TO: CSIC/LR/024

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most current copper nanoparticle synthesis methodologies require conditions non-environmentally friendly or the use low temperatures and generate particles that are either too small and easily oxidizable or too large. A new scalable synthesis method is proposed, using non-toxic chemicals, environmentally friendly solvents, and renewable materials. This allows for large-scale production of nanoparticles, overcoming the traditional challenges associated with copper oxidation and long synthesis times.



### APPLICATIONS AND BENEFITS

The method uses continuous synthesis, facilitated by microwaves, reducing reaction timings, to obtain large quantities of copper nanoparticles with improved properties: stability against oxidation, reduced size, and high homogeneity in particle shape and size distribution. The nanoparticles obtained have a low oxide content, which improves their electrical conductivity. They are highly useful in conductive inks for electronic printing, radio frequency antennas, catalysts, conductive paints or coatings.

INSTITUTE: ICMIM

TRL **1** 2 3 4 5 6 7 8 9

## NON-INVASIVE HIGH-PRECISION OPTICAL CALIBRATION STANDARD

CATEGORY: MATERIALS

TO: CSIC/IG/153

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Non-invasive alternative for high-precision optical calibration, overcoming the limitations of conventional rigid patterns that cannot perform calibration under real operating conditions. By integrating different pattern types into a single structure, it enables simultaneous assessment of critical parameters without interfering with the sample or requiring system modifications, extending its usefulness beyond standard calibration techniques.



### APPLICATIONS AND BENEFITS

The developed procedure enables real-time calibration of optical systems in scientific, biomedical, industrial and forensic workflows where metrological accuracy is essential. Its non-invasive approach avoids specific sample preparations and supports quality control in regulated environments such as digital histology, biobanks, automated screening or multichannel 3D reconstruction. This ensures reliable imaging and traceability without altering equipment operation.

INSTITUTE: IMB-CNM

TRL **1** 2 3 4 5 6 7 8 9

## ANTI-COUNTERFEITING INKS WITH INTEGRATED MICROCHIPS

CATEGORY: MATERIALS

TO: CSIC/IG/169

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A unique authentication approach based on fully customizable microchips that can be integrated into almost any type of ink, from standard commercial formulations to high-security coatings. Unlike current solutions relying on optical effects or chemical markers—which can be replicated with advanced imaging and printing tools—these microchips provide unclonable identifiers while remaining compatible with existing industrial printing processes, offering a superior level of protection.



### APPLICATIONS AND BENEFITS

Inks with embedded microchips enable the authentication of documents, packaging and products through unique optically readable information, delivering true item-level traceability. Their easy incorporation into commercial inks and industrial coatings supports sectors needing strong protection against increasingly sophisticated counterfeiting. The solution enhances security without altering printing workflows, reduces risk, and improves control across high-value and sensitive industries.

INSTITUTE: IMB-CNM

TRL **1** 2 3 4 5 6 7 8 9

## LUMINESCENCE-BASED ANALYSIS METHOD FOR THE DIRECT QUANTIFICATION OF PHOTOPHYSICAL PARAMETERS

CATEGORY: MATERIALS

TO: CSIC/MO/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An experimental method that analyses persistent luminescence in the frequency domain using modulated excitation and transfer functions. Unlike conventional techniques, it enables the separation of processes occurring on vastly different timescales and allows for the direct quantification of key physical parameters without relying on empirical fitting models, thus addressing a long-standing unmet need in the advanced characterisation of these materials.



### APPLICATIONS AND BENEFITS

A powerful tool for the development and optimisation of luminescent materials used in bioimaging, signalling, photocatalysis and security systems. It enables the analysis of processes over an exceptionally wide range (1 mHz–100 MHz), under continuous excitation and real operating conditions. The method is non-invasive, versatile and compatible with standard optical techniques. It has been validated in advanced luminescent crystals, where proof-of-concept has been successfully demonstrated.

INSTITUTE: ICMS

TRL

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## NITROGEN-DOPED CARBON MATERIALS DERIVED FROM LIGNOCELLULOSIC WASTE

CATEGORY: MATERIALS

TO: CSIC/MC/113

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Development of novel porous catalytic materials derived from agro-industrial residues through hydrothermal carbonisation and nitrogen doping using urea. These carbon materials, featuring tuneable porosity, high specific surface area and a high nitrogen content, are obtained via a simple and robust process. The technology provides a high value-added application for problematic lignocellulosic agricultural residues, specifically grape pomace from winemaking and spent grain from beer production.



### APPLICATIONS AND BENEFITS

These materials are highly relevant due to their applicability in energy storage systems, gas capture, adsorption and catalysis. Using these materials, highly efficient electrocatalysts for the oxygen reduction reaction (ORR) in fuel cells have been developed without the use of precious metals, thereby offering a sustainable and cost-effective alternative to conventional platinum/carbon catalysts.

INSTITUTE: ICP

TRL

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## ROTATING SYSTEM FOR ION IMPLANTATION IN MICROSTRUCTURED MATERIALS

CATEGORY: MATERIALS

TO: CSIC/AI/014

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Rotary system, compatible with existing ion implanters, that allows homogeneous ion implantation on surfaces of microstructured materials. The device avoids the shadows generated when tilting samples during the process, achieving a uniform distribution of impurities.



### APPLICATIONS AND BENEFITS

This system features a sample holder that maintains a fixed 7-degree tilt while rotating. Rotation is transmitted from an external motor via a magnetic coupling that preserves the vacuum. Its speed, slower than that of the ion beam, ensures uniform exposure of the entire microstructured surface, while an additional metal plate collects unimpacted ions, allowing precise measurement of the implantation dose.

INSTITUTE: IO

TRL **1** 2 3 4 5 6 7 8 9

## AUTOTHERMAL PYROLYSIS FOR ENHANCED ENERGY AND OPERATIONAL EFFICIENCY

CATEGORY: MATERIALS

TO: CSIC/JB/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Conventional pyrolysis requires an external heat supply, which limits the effective thermal transfer area and necessitates its expansion when designing higher-capacity reactors. Moreover, as reactor size increases, the temperature and heating rate of the particles being pyrolysed are adversely affected, leading to temperature gradients and irregularities in mass and energy transfer. This technology enables pyrolysis to be carried out without the need to redesign the reactor, thereby reducing both operational (OPEX) and capital expenditure (CAPEX).



### APPLICATIONS AND BENEFITS

Thanks to the optimised process, validated at pilot scale, overall system performance is enhanced as heat is generated from within the reactor itself. This constitutes a significant competitive advantage in terms of efficiency, since eliminating external heating agents ensures a uniform distribution of heat-release points throughout the reaction zone, facilitating rapid absorption by the endothermic reactions inherent to the pyrolysis process.

INSTITUTE: ICB

TRL **1** 2 3 4 5 6 7 8 9

## CATALYST FOR UPGRADING FISCHER-TROPSCH HYDROCARBONS INTO DROP-IN FUELS

CATEGORY: MATERIALS

TO: CSIC/JB/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A bifunctional catalyst prepared by sequential impregnation that uses herringbone carbon nanofibers (CNF) as a support for platinum nanoparticles and metal oxides. This design enhances hydroisomerization and hydrocracking activity, especially when processing waxes in the Fischer-Tropsch process, thanks to the formation of nanometric “catalytic islands,” resulting in biofuels with higher yields and better properties than conventional catalysts.



### APPLICATIONS AND BENEFITS

These type of catalyst, supported on carbon nanofiber (CNF) and hybridized with metal oxides, enable the production of an optimized biofuel during the hydroisomerization and hydrocracking stages of Fischer-Tropsch waxes. The improvements achieved in these process stages are primarily due to the less acidic nature of the carbon nanofiber supports compared to other conventional supports. The resulting biofuel, teste at a pilot scale, is suitable for aviation and maritime transport.

INSTITUTE: ICB

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGHLY SENSITIVE GAS SENSORS FOR NO<sub>2</sub> DETECTION AT ROOM TEMPERATURE

CATEGORY: MATERIALS

TO: CSIC/NG/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Photoactivated sensor devices based on highly porous carbon-based materials functionalized with nitrogen heteroatoms that offer exceptional sensitivity, capable of detecting NO<sub>2</sub> at levels as low as 1 ppb under real operating conditions and at room temperature—something that few current technologies can achieve without requiring heating elements or bulky systems. Their high selectivity toward NO<sub>2</sub>, even in the presence of interfering gases such as ammonia or acetone, ensures superior accuracy compared to conventional commercial sensors based on metal oxides or electrochemical methods.



### APPLICATIONS AND BENEFITS

These systems offer elevated selectivity and sensitivity for NO<sub>2</sub> detection at ppb level, ensuring stable operation and prolonged life time under ambient conditions. Their robust and easily integrable design enables the development of compact, low-power portable devices, clearly setting them apart from alternative technologies that are more complex, less stable, or difficult to miniaturize.

INSTITUTE: ICV

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGH-PERFORMANCE AND SUSTAINABLE “MEA” TECHNOLOGY FOR ELECTROLYSIS AIMED AT GREEN HYDROGEN PRODUCTION

CATEGORY: MATERIALS

TO: CSIC/MO/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Membrane-electrode assembly (MEA) technology incorporates an innovative architecture that integrates catalysts through a single-step vapor-phase deposition process, completely eliminating the use of ionomers and solvents. Unlike conventional MEAs based on catalytic inks, this technology enhances efficiency, stability, and reproducibility, while also reducing catalyst loading and minimizing environmental impact. It is furthermore fully compatible with industrial scaling for both acidic and alkaline electrolysis.



### APPLICATIONS AND BENEFITS

Designed for integration into electrolyzer stacks intended for green hydrogen production, these MEAs deliver high electrochemical performance, reduced active material consumption, and enhanced operational stability. They are compatible with industrial processes and with electrolysis in both acidic and alkaline environments. The technology has been validated in laboratory and relevant settings (TRL 4/5), demonstrating its technical viability and scalability potential.

INSTITUTE: ICMS

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SIMULTANEOUS PURIFICATION AND FUNCTIONALIZATION OF METAL-ORGANIC FRAMEWORKS (MOFs) USING NATURAL PHOSPHOLIPIDS

CATEGORY: MATERIALS

TO: CSIC/MO/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Purifying nanoscale Metal-organic frameworks (MOFs) (<200 nm) is a crucial step and a major bottleneck in the industrial production of these porous hybrid materials. Classical methods such as centrifugation or solvent washing cause aggregation, material loss, and damage to thermally sensitive frameworks. Our new technology addresses this urgent need by inducing a phase separation using natural phospholipids. Unlike previous techniques, this scalable method combines purification and functionalization in a single, gentle step, removing impurities and toxic solvents without affecting their valuable porosity.



### APPLICATIONS AND BENEFITS

This innovative and sustainable process instantly provides the material with a biocompatible coating. The proof of concept has been developed with remarkable success at a pilot scale (TRL 4/5), successfully purifying several key MOFs such as PCN-222, MOF-801, and PCN-224. Its unique characteristics ensure structural integrity and greatly facilitate the use of these nanomaterials in two major fields: advanced drug delivery systems in biomedicine and demanding catalysis processes for the industrial sector.

INSTITUTE: IIQ

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SUSTAINABLE PRODUCTION OF $\gamma$ - VALEROLACTONE VIA PHOTOTHERMAL CATALYSIS

CATEGORY: MATERIALS

TO: CSIC/IG/142

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A sustainable and efficient approach to obtaining  $\gamma$ -valerolactone from biomass through photothermal catalysis without the need for hydrogen and with significantly lower energy, temperature and time requirements than conventional processes. The use of scalable, cost-effective nickel-based catalysts, combined with compatibility with solar-driven synthesis, reduces costs and enhances safety. This approach clearly differentiates itself from existing methods, which are more expensive, energy-intensive and less sustainable.



### APPLICATIONS AND BENEFITS

This method enables the safer, faster and more sustainable synthesis of  $\gamma$ -valerolactone, meeting the demand of sectors such as pharmaceuticals, agrochemicals and polymer manufacturing that seek renewable alternatives to petroleum-derived products. By utilising biomass and reducing energy consumption, the process enhances competitiveness and facilitates the production of high value-added products. Its approach lowers costs and promotes circular economy models.

INSTITUTE: IMB-CNM

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## HIGHLY SELECTIVE CATALYST FOR CONVERTING CAPTURED $\text{CO}_2$ INTO CO

CATEGORY: MATERIALS

TO: CSIC/MC/112

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The incorporation of Cs and In into nickel-ceria catalysts increases oxygen mobility, basicity, and metal dispersion, resulting in higher  $\text{CO}_2$  conversion and CO selectivity in the Reverse Water-Gas Shift (RWGS) reaction. Compared with other technologies, these catalysts exhibit a high dispersion of active phases, superior high-temperature stability, and higher productivity per unit mass of catalyst, reducing costs and supporting a circular-economy approach.



### APPLICATIONS AND BENEFITS

The catalyst stands out for its high efficiency in the RWGS reaction. This reaction is essential for converting captured  $\text{CO}_2$  into CO, a key intermediate for producing synthetic fuels and chemicals such as methanol, Fischer-Tropsch hydrocarbons, and oxoalcohols. Thanks to its strong performance, the catalyst supports industrial decarbonization by helping to "close the carbon loop" when used together with renewable hydrogen, turning emissions into valuable resources.

INSTITUTE: ICP

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## DEVICE FOR DIRECT DEPOSITION BY VACUUM SUBLIMATION

CATEGORY: MATERIALS

TO: CSIC/AF/012

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The sublimator allows direct deposition on the final surface of any substrate using a simple process without the need of ultra-high vacuum. The distance between the substrate and the sample to be sublimated can be modified for a better control of the process variables.



### APPLICATIONS AND BENEFITS

Applicable to a large number of surfaces of different natures, dimensions and functions. It can be used in standard R&D laboratories, without special environmental conditions.

INSTITUTE: ICMAB

TRL **1** 2 3 4 5 6 7 8 9

## ULTRA-FAST PRODUCTION OF FLEXIBLE SUPERCONDUCTING TAPES

CATEGORY: MATERIALS

TO: CSIC/AF/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Superconducting materials transport electricity without energy losses if they are below a critical temperature. This new method based on TLAG-CSD (Transient Liquid Assisted Growth Chemical Solution Deposition) allows them to be synthesized by improving the structural homogeneity of the superconducting layer, is 100 times faster than the methods currently used and has the characteristics to be considered green chemistry.



### APPLICATIONS AND BENEFITS

The method is ideal for the production of flexible superconducting tapes for magnetic resonance imaging equipment, particle accelerators, nuclear fusion reactors, etc.

INSTITUTE: ICMAB

TRL **1** 2 3 4 5 6 7 8 9

## SELECTIVE PHOTOCATALYTIC OXIDATION PROCESS TO PRODUCE PHENOL IN A MORE SUSTAINABLE WAY

CATEGORY: MATERIALS

TO: CSIC/AF/020

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The efficient transformation of C-H bonds into more reactive functional groups is a challenge in modern chemistry. The method developed is a photocatalytic oxidation process that allows obtaining multiple end products from different starting molecules. The proof of concept is optimizing and scaling up the method for the production of phenol.



### APPLICATIONS AND BENEFITS

Easily scalable manufacturing method that does not use organic solvents. High yields can be obtained without generating by-products. Different products can be obtained with the same starting material by modifying the reaction time.

INSTITUTE: ICMAB

TRL **1** 2 3 4 5 6 7 8 9

## NEW HIGH-PERFORMANCE CATALYST FOR H<sub>2</sub> PRODUCTION BY GLYCEROL VAPOUR REFORMING

CATEGORY: MATERIALS

TO: CSIC/JB/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most commercial nickel catalysts supported on CeO<sub>2</sub> and MgO for H<sub>2</sub> production generate methane during glycerol steam reforming, reducing the efficiency of the process. In addition, they lack stability at 900°C, the key temperature for multi-cycle reforming, the most efficient way to produce hydrogen. The new catalyst stands out for its high performance in multi-cycle reforming processes, withstanding high temperatures and avoiding the formation of by-products. This facilitates industrial catalytic reforming and optimises mass hydrogen production.



### APPLICATIONS AND BENEFITS

This highly efficient catalyst is distinguished by its high performance in multi-cycle reforming processes, enhancing the mass production of hydrogen, a key factor towards renewable energies. The MgO-Al<sub>2</sub>O<sub>3</sub> or MgO-Al<sub>2</sub>O<sub>3</sub>-CeO<sub>2</sub> mixed oxide supports used have a specific surface area of at least 45 m<sup>2</sup>/g, which can be increased by high-temperature treatment.

INSTITUTE: ICB

TRL

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## DEVICE FOR DEFROSTING SURFACES BY GENERATING ACOUSTIC WAVES

CATEGORY: MATERIALS

TO: CSIC/JD/171

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Currently, the problem of ice build-up on surfaces is primarily solved by applying antifreeze liquids. The developed device enables to remove accumulated ice and/or prevent its formation and accumulation without the need for external applicators and thanks to the generation of acoustic waves produced by the electrical activation of a material with piezoelectric and/or ferroelectric activity.



### APPLICATIONS AND BENEFITS

The device can be adapted to any type of object, regardless of its shape or properties (including metals, ceramics, composites, or polymers). The developed process is more energy-efficient because it requires activating only the interface between the substrate and ice, rather than completely melting the ice. The device is extremely useful in fields such as aeronautics and telecommunications, energy production and transportation, and other industrial processes.

INSTITUTE: ICMS

TRL

1 2 3 4 5 6 7 8 9

## HIGHLY MONODISPERSE AND SPHERICAL $\text{TiO}_2$ PARTICLES FOR AND PHOTONIC APPLICATIONS

CATEGORY: MATERIALS

TO: CSIC/LR/025

### DIFFERENTIAL VS OTHER TECHNOLOGIES



One of the limitations of the use of  $\text{TiO}_2$  in industry is the impossibility of producing monodisperse particles in an easy manner, a crucial feature in scattering or optical diffraction. The developed technique allows the production of highly monodisperse and spherical particles with a wide range of sizes, from a fraction to several micrometres.



### APPLICATIONS AND BENEFITS

The particles are obtained by simple hydrolysis of commercially available metal alkoxides. The reaction takes place at room temperature and under mild conditions. The particles are produced using standard equipment with low energy consumption. The process is industrially scalable and has applications in fields such as photonics and catalysis.

INSTITUTE: ICMN

TRL **1** 2 3 4 5 6 7 8 9

## STRUCTURAL CERAMIC MATERIAL SUSTAINABLY OBTAINED FROM DEMOLITION WASTE

CATEGORY: MATERIALS

TO: CSIC/MC/105

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Structural ceramic material obtained from raw materials where more than 70% come from construction/demolition waste. The process does not require high-temperature heat treatment, with the consequent energy savings.



### APPLICATIONS AND BENEFITS

The advantages of the technology are the reuse of wastes that are currently used in very low added value applications (road slope fillings), and their valorization as secondary raw materials, generating new types of ceramic products in sustainable circular economy processes.

INSTITUTE: ICV

TRL **1** 2 3 4 5 6 7 8 9

## OPTOFLUIDIC MICROREACTOR FOR PHOTODEGRADATION OF ORGANIC AQUEOUS POLLUTANTS

CATEGORY: MATERIALS

TO: CSIC/PT/070

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An optofluidic threaded microreactor (OTM) consisting of a externally threaded element (ETE) covered with a suitable catalytic material. It has an improved design compared with helical capillary microreactors with optimal use of reactor space and high surface-to-volume ratio maximizing aqueous pollution photodegradation. It has also a better performance than expensive chip-type microreactors.



### APPLICATIONS AND BENEFITS

It operates efficiently in the degradation of contaminants in water. It has been successfully tested in the photodegradation of ibuprofen under low-power UVA radiation, exhibiting very high and stable catalytic activity during long-term experiments in flow mode operation.

INSTITUTE: INCAR

TRL **1** 2 3 4 5 6 7 8 9

## PORTABLE ELECTROCHEMICAL SENSOR FOR DIRECT DETECTION OF CONTAMINANTS IN WATER

CATEGORY: MATERIALS

TO: CSIC/AF/010

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The sensor enables the detection of contaminants in the area where the sample was obtained by personnel without specific training. The sample does not require any prior processing steps, it can be deposited directly on the sensor. This way, sample handling steps and the use of contaminating reagents are avoided.



### APPLICATIONS AND BENEFITS

Versatile equipment validated for chemical oxygen demand, which allows the detection of organic contaminants, and which has also been tested for the detection of heavy metals. It can be applied to water released in a treatment plant to reduce its environmental impact, and in companies such as meat processing plants to detect the release of contaminants, as well as in the environmental monitoring of rivers and lakes.

INSTITUTE: IMB-CNM/ICMAB

TRL

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## MAGNETIC FERRITE PERMANENT MAGNETS AS A SUSTAINABLE ALTERNATIVE TO RARE-EARTH BASED MAGNETS

CATEGORY: MATERIALS

TO: CSIC/MC/092

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Permanent magnets make possible to store, supply and convert electrical energy into mechanical energy and vice versa. The most competitive ones are based on rare earths. The permanent magnets developed are obtained by sintering magnetic ferrite particles and an organic solvent. The process is simple and economical, with temperatures around 10% lower than commonly used resulting in energy savings of more than 40%.



### APPLICATIONS AND BENEFITS

The main applications of these magnets are in the renewable energy generation, storage sector (e.g. wind turbines and flywheels), aeronautics and automotive sector (magnets for alternators and motors for electric or hybrid vehicles).

INSTITUTE: ICV

TRL

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# ENVIRONMENT



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## DRONE SENSOR FOR SOIL MOISTURE AND IRRIGATION EFFICIENCY

CATEGORY: ENVIRONMENT

TO: CSIC/VC/039

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A highly precise radio wave drone-mounted sensor, capable of providing soil moisture measurements both at the surface (5 cm) and at depth (50 cm), with a pixel size of around 20 m and a coverage rate of 30 ha/h. This makes it a particularly useful tool for precision farming and sustainable water resource management.



### APPLICATIONS AND BENEFITS

Droughts require more accurate technologies to measure soil moisture. The solution uses a drone sensor that reaches a depth of 50 cm, with a resolution of 20 m and coverage of 30 ha/h. It provides reliable data on soil water status even in drought conditions. The data collected by this device enables more efficient use of irrigation water, the selection of the most suitable crop for each plot based on soil moisture at depth and the detection of leaks in water distribution networks.

INSTITUTE: ICE

TRL

1 2 3 4 5 6 7 8 9

## HIGHLY SENSITIVE GAS SENSORS FOR NO<sub>2</sub> DETECTION AT ROOM TEMPERATURE

CATEGORY: ENVIRONMENT

TO: CSIC/NG/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Photoactivated sensor devices based on highly porous carbon-based materials functionalized with nitrogen heteroatoms that offer exceptional sensitivity, capable of detecting NO<sub>2</sub> at levels as low as 1 ppb under real operating conditions and at room temperature—something that few current technologies can achieve without requiring heating elements or bulky systems. Their high selectivity toward NO<sub>2</sub>, even in the presence of interfering gases such as ammonia or acetone, ensures superior accuracy compared to conventional commercial sensors based on metal oxides or electrochemical methods.



### APPLICATIONS AND BENEFITS

These systems offer elevated selectivity and sensitivity for NO<sub>2</sub> detection at ppb level, ensuring stable operation and prolonged life time under ambient conditions. Their robust and easily integrable design enables the development of compact, low-power portable devices, clearly setting them apart from alternative technologies that are more complex, less stable, or difficult to miniaturize.

INSTITUTE: ICV

TRL

1 2 3 4 5 6 7 8 9

## SMART MODULAR SYSTEM FOR THE MEASUREMENT AND CONTROL OF AQUATIC FLOWS

CATEGORY: ENVIRONMENT

TO: CSIC/CJ/023

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Modular system that quantifies in real time the filtered water volume and the effective sampling depth, providing accuracy, traceability and efficiency to aquatic monitoring programmes.



### APPLICATIONS AND BENEFITS

The device features a modular, lightweight design easily integrated into existing system, being compatible with different nets and sampling configurations. It allows the real-time visualisation and wireless remote control. It offers high accuracy and traceability in flow rate and filtered volume measurements, resulting in improved data quality for environmental and scientific reporting. Furthermore, it is quick to install, requires low maintenance and presents high durability.

INSTITUTE: IEO

TRL

1 2 3 4 5 6 7 8 9

## CARBON FOAM CONTAINER FOR THE PHYTOREMEDIATION OF CONTAMINATED SOILS

CATEGORY: ENVIRONMENT

TO: CSIC/AI/011

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An integrated phytoremediation system based on a cylindrical carbon-foam container produced from sucrose and iron. The device functions both as a plant pot and as an active soil amendment, making it particularly suitable for the decontamination of industrial, mining, forestry, and agricultural soils. It has the advantage of being placed on the ground without the need for excavation, creating a localized and stable treatment zone.



### APPLICATIONS AND BENEFITS

Cylindrical, self-supporting and porous container manufactured through a straightforward moulding and thermal foaming process using sucrose and iron nitrate as precursors. The resulting material is a carbon foam incorporating embedded iron nanoparticles, which serves both as a physical support for plant growth and as an adsorbent agent for contaminants.

INSTITUTE: INCAR

TRL

1 2 3 4 5 6 7 8 9

## AUTOTHERMAL PYROLYSIS FOR ENHANCED ENERGY AND OPERATIONAL EFFICIENCY

CATEGORY: ENVIRONMENT

TO: CSIC/JB/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Conventional pyrolysis requires an external heat supply, which limits the effective thermal transfer area and necessitates its expansion when designing higher-capacity reactors. Moreover, as reactor size increases, the temperature and heating rate of the particles being pyrolysed are adversely affected, leading to temperature gradients and irregularities in mass and energy transfer. This technology enables pyrolysis to be carried out without the need to redesign the reactor, thereby reducing both operational (OPEX) and capital expenditure (CAPEX).



### APPLICATIONS AND BENEFITS

Thanks to the optimised process, validated at pilot scale, overall system performance is enhanced as heat is generated from within the reactor itself. This constitutes a significant competitive advantage in terms of efficiency, since eliminating external heating agents ensures a uniform distribution of heat-release points throughout the reaction zone, facilitating rapid absorption by the endothermic reactions inherent to the pyrolysis process.

INSTITUTE: ICB

TRL

1 2 3 4 5 6 7 8 9

## ADVANCED GEOREFERENCED UNDERWATER VIDEO ANALYSIS SYSTEM

CATEGORY: ENVIRONMENT

TO: CSIC/CJ/024

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Underwater video analysis tool enabling precise, georeferenced annotation of species and relevant elements. It integrates and organizes all information collected during dives into a structured geodatabase, simplifying its retrieval, traceability, and subsequent technical processing.



### APPLICATIONS AND BENEFITS

It significantly reduces the time required for underwater video analysis. It enables precise, georeferenced annotation of species and relevant elements, organizes biological, ecological, and impact data into a single geodatabase, and streamlines the review and editing of recorded information. It also facilitates the generation of lists and queries using structured filters, while integrating georeferenced photographs and associated sample catalogues.

INSTITUTE: IEO

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## NITROGEN-DOPED CARBON MATERIALS DERIVED FROM LIGNOCELLULOSIC WASTE

CATEGORY: ENVIRONMENT

TO: CSIC/MC/113

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Development of novel porous catalytic materials derived from agro-industrial residues through hydrothermal carbonisation and nitrogen doping using urea. These carbon materials, featuring tunable porosity, high specific surface area and a high nitrogen content, are obtained via a simple and robust process. The technology provides a high value-added application for problematic lignocellulosic agricultural residues, specifically grape pomace from winemaking and spent grain from beer production.



### APPLICATIONS AND BENEFITS

These materials are highly relevant due to their applicability in energy storage systems, gas capture, adsorption and catalysis. Using these materials, highly efficient electrocatalysts for the oxygen reduction reaction (ORR) in fuel cells have been developed without the use of precious metals, thereby offering a sustainable and cost-effective alternative to conventional platinum/carbon catalysts.

INSTITUTE: ICP

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## PORTABLE ELECTROCHEMICAL SENSOR FOR DIRECT DETECTION OF CONTAMINANTS IN WATER

CATEGORY: ENVIRONMENT

TO: CSIC/AF/010

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The sensor enables the detection of contaminants in the area where the sample was obtained by personnel without specific training. The sample does not require any prior processing steps, it can be deposited directly on the sensor. This way, sample handling steps and the use of contaminating reagents are avoided.



### APPLICATIONS AND BENEFITS

Versatile equipment validated for chemical oxygen demand, which allows the detection of organic contaminants, and which has also been tested for the detection of heavy metals. It can be applied to water released in a treatment plant to reduce its environmental impact, and in companies such as meat processing plants to detect the release of contaminants, as well as in the environmental monitoring of rivers and lakes.

INSTITUTE: IMB-CNM/ICMAB

TRL **1** 2 3 4 5 6 7 8 9

## RECOVERY OF VERY HIGH PURITY LI, NI AND CO FROM THE BLACK MASS OF DISCARDED LITHIUM-ION BATTERIES

CATEGORY: ENVIRONMENT

TO: CSIC/MC/106

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Lithium-ion batteries contain a high percentage of hazardous heavy metals, so their recovery is key to preserve natural resources and environment. A process by means of carbothermal reduction and magnetic separation of the black mass of these batteries has been developed, whereby nickel, cobalt and lithium are obtained. This black mass is previously obtained by separating the mixture of the batteries' anode and cathode.



### APPLICATIONS AND BENEFITS

The main advantage is the obtaining of nickel, cobalt and lithium metals with a yield of 98 %, 92 % and 99 % respectively and a purity of over 98 %. This allows their reuse for other industrial processes, including the manufacture of new batteries, favouring the circular economy. In addition, it is possible to take advantage of the graphite also found in the black mass to transform it into graphene oxide and reduced graphene oxide.

INSTITUTE: CENIM

TRL **1** 2 3 4 5 6 7 8 9

## STRUCTURAL CERAMIC MATERIAL OBTAINED IN A SUSTAINABLE WAY FROM DEMOLITION WASTES

CATEGORY: ENVIRONMENT

TO: CSIC/MC/105

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Structural ceramic material obtained from raw materials that come from more than 70% of construction/demolition waste, with a process that does not require high-temperature heat treatment, with the consequent energy savings.



### APPLICATIONS AND BENEFITS

The advantages of the technology are the reuse of wastes that are currently used in very low value applications (road slope fillings), and their valorization as secondary raw materials, generating new types of ceramic products in sustainable circular economy processes.

INSTITUTE: ICV

TRL

1 2 3 4 5 6 7 8 9

## RECOVERY OF LITHIUM FROM USED BATTERIES BY HYDROLYSIS AT TEMPERATURES BELOW 600°C

CATEGORY: ENVIRONMENT

TO: CSIC/MC/110

### DIFFERENTIAL VS OTHER TECHNOLOGIES



From the used lithium ion battery waste the "black mass" is obtained. This fraction contains the components of greatest interest. Many technologies have been developed to extract the lithium from the black mass, using either high temperatures or strong reagents such as acids.



### APPLICATIONS AND BENEFITS

The developed technology allows a simple recovery of lithium from the degradation of the electrolytes of depleted lithium ion batteries by hydrolysis, at milder temperatures below 600°C, and using water as the only reagent. It does not require purification steps or reprocessing of lithium salts. The recovered lithium can be subsequently used for the manufacture of new electrolytes or to be integrated in the manufacture of new batteries.

INSTITUTE: CENIM

TRL

1 2 3 4 5 6 7 8 9

## OPTOFLUIDIC MICROREACTOR FOR PHOTODEGRADATION OF ORGANIC AQUEOUS POLLUTANTS

CATEGORY: ENVIRONMENT

TO: CSIC/PT/070

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An optofluidic threaded microreactor (OTM) consisting of an externally threaded element (ETE) covered with a suitable catalytic material. It has an improved design compared with helical capillary microreactors with optimal use of reactor space and high surface-to-volume ratio maximizing aqueous pollution photodegradation. It has also a better performance than expensive chip-type microreactors.



### APPLICATIONS AND BENEFITS

It operates efficiently in the degradation of contaminants in water. It has been successfully tested in the photodegradation of ibuprofen under low-power UVA radiation, exhibiting very high and stable catalytic activity during long-term experiments in flow mode operation.

INSTITUTE: INCAR

TRL

1 2 3 4 5 6 7 8 9

## PROCESS FOR BLOOD REVALORIZATION TO GENERATE AN ANIMAL FEED PRODUCT WITH HIGH ADDED VALUE

CATEGORY: ENVIRONMENT

TO: CSIC/ME/031

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most of the blood from slaughterhouses is a waste management problem for this type of industry. This residual blood contains a large amount of components of interest and, therefore, can be used as raw material to generate products with high added value. To revalue the blood, hydrolysis processes are used to obtain peptides and amino acids. Chemical hydrolysis is currently used, but this process is not sustainable. This new enzymatic hydrolysis process makes it possible to obtain peptides that can be used as animal food additives with very beneficial properties.



### APPLICATIONS AND BENEFITS

The peptides obtained by the new enzymatic hydrolysis method present characteristics that make them interesting to be used in animal feed, especially in the fish farming industry. They have been shown to promote growth rate, increase swimming performance and allow the prevention and/or treatment of stress and behavioural disorders of the subjects. Similarly, the bioactive peptides generated show antioxidant, anti-inflammatory, hypoglycaemic and immunomodulatory activity. Therefore, the new hydrolysate can be used in different food and pharmaceutical applications.

INSTITUTE: IATA/IATS

TRL

1 2 3 4 5 6 7 8 9



# CHEMISTRY



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## AUTOTHERMAL PYROLYSIS FOR ENHANCED ENERGY AND OPERATIONAL EFFICIENCY

CATEGORY: CHEMISTRY

TO: CSIC/JB/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Conventional pyrolysis requires an external heat supply, which limits the effective thermal transfer area and necessitates its expansion when designing higher-capacity reactors. Moreover, as reactor size increases, the temperature and heating rate of the particles being pyrolysed are adversely affected, leading to temperature gradients and irregularities in mass and energy transfer. This technology enables pyrolysis to be carried out without the need to redesign the reactor, thereby reducing both operational (OPEX) and capital expenditure (CAPEX).



### APPLICATIONS AND BENEFITS

Thanks to the optimised process, validated at pilot scale, overall system performance is enhanced as heat is generated from within the reactor itself. This constitutes a significant competitive advantage in terms of efficiency, since eliminating external heating agents ensures a uniform distribution of heat-release points throughout the reaction zone, facilitating rapid absorption by the endothermic reactions inherent to the pyrolysis process.

INSTITUTE: ICB

TRL

1 2 3 4 5 6 7 8 9

## COMPACT AND VERSATILE ELECTROCHEMICAL DEVICE FOR FLOW CELLS, FUEL CELLS OR HYDROGEN ELECTROLYSER

CATEGORY: CHEMISTRY

TO: CSIC/AF/025

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A compact electrochemical device comprising fewer components than conventional systems, simplifying the assembly process and significantly reducing the risk of leaks. Its compact design requires lower applied pressure, resulting in a reduction in both volume and weight.



### APPLICATIONS AND BENEFITS

A highly versatile device that can be used as a flow cell, fuel cell or hydrogen electrolyser. It is particularly well suited to applications where leak prevention is critical or where frequent assembly and disassembly are required. Its reduced size facilitates use in portable applications.

INSTITUTE: ICMA B

TRL

1 2 3 4 5 6 7 8 9

## SIMULTANEOUS PURIFICATION AND FUNCTIONALIZATION OF METAL-ORGANIC FRAMEWORKS (MOFs) USING NATURAL PHOSPHOLIPIDS

CATEGORY: CHEMISTRY

TO: CSIC/MO/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Purifying nanoscale Metal-organic frameworks (MOFs) (<200 nm) is a crucial step and a major bottleneck in the industrial production of these porous hybrid materials. Classical methods such as centrifugation or solvent washing cause aggregation, material loss, and damage to thermally sensitive frameworks. Our new technology addresses this urgent need by inducing a phase separation using natural phospholipids. Unlike previous techniques, this scalable method combines purification and functionalization in a single, gentle step, removing impurities and toxic solvents without affecting their valuable porosity.



### APPLICATIONS AND BENEFITS

This innovative and sustainable process instantly provides the material with a biocompatible coating. The proof of concept has been developed with remarkable success at a pilot scale (TRL 4/5), successfully purifying several key MOFs such as PCN-222, MOF-801, and PCN-224. Its unique characteristics ensure structural integrity and greatly facilitate the use of these nanomaterials in two major fields: advanced drug delivery systems in biomedicine and demanding catalysis processes for the industrial sector.

INSTITUTE: IIQ

TRL

1 2 3 4 5 6 7 8 9

## SUSTAINABLE PRODUCTION OF $\gamma$ -VALEROLACTONE VIA PHOTOTHERMAL CATALYSIS

CATEGORY: CHEMISTRY

TO: CSIC/IG/142

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A sustainable and efficient approach to obtaining  $\gamma$ -valerolactone from biomass through photothermal catalysis without the need for hydrogen and with significantly lower energy, temperature and time requirements than conventional processes. The use of scalable, cost-effective nickel-based catalysts, combined with compatibility with solar-driven synthesis, reduces costs and enhances safety. This approach clearly differentiates itself from existing methods, which are more expensive, energy-intensive and less sustainable.



### APPLICATIONS AND BENEFITS

This method enables the safer, faster and more sustainable synthesis of  $\gamma$ -valerolactone, meeting the demand of sectors such as pharmaceuticals, agrochemicals and polymer manufacturing that seek renewable alternatives to petroleum-derived products. By utilising biomass and reducing energy consumption, the process enhances competitiveness and facilitates the production of high value-added products. Its approach lowers costs and promotes circular economy models.

INSTITUTE: IMB-CNM

TRL

1 2 3 4 5 6 7 8 9

## CATALYST FOR UPGRADING FISCHER-TROPSCH HYDROCARBONS INTO DROP-IN FUELS

CATEGORY: CHEMISTRY

TO: CSIC/JB/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A bifunctional catalyst prepared by sequential impregnation that uses herringbone carbon nanofibers (CNF) as a support for platinum nanoparticles and metal oxides. This design enhances hydroisomerization and hydrocracking activity, especially when processing waxes in the Fischer-Tropsch process, thanks to the formation of nanometric "catalytic islands," resulting in biofuels with higher yields and better properties than conventional catalysts.



### APPLICATIONS AND BENEFITS

This type of catalysts, supported on carbon nanofiber (CNF) and hybridized with metal oxides, enable the production of an optimized biofuel during the hydroisomerization and hydrocracking stages of Fischer-Tropsch waxes. The improvements achieved in these process stages are primarily due to the less acidic nature of the carbon nanofiber supports compared to other conventional supports. The resulting biofuel, teste at a pilot scale, is suitable for aviation and maritime transport.

INSTITUTE: ICB

TRL **1** 2 3 4 5 6 7 8 9

## RECOVERY OF LITHIUM FROM USED BATTERIES BY HYDROLYSIS AT TEMPERATURES BELOW 600°C

CATEGORY: CHEMISTRY

TO: CSIC/MC/110

### DIFFERENTIAL VS OTHER TECHNOLOGIES



From the used lithium ion battery waste the "black mass" is obtained. This fraction contains the components of greatest interest. Many technologies have been developed to extract the lithium from the black mass, using either high temperatures or strong reagents such as acids.



### APPLICATIONS AND BENEFITS

The developed technology allows a simple recovery of lithium from the degradation of the electrolytes of depleted lithium ion batteries by hydrolysis, at milder temperatures below 600°C, and using water as the only reagent. It does not require purification steps or reprocessing of lithium salts. The recovered lithium can be subsequently used for the manufacture of new electrolytes or to be integrated in the manufacture of new batteries.

INSTITUTE: CENIM

TRL **1** 2 3 4 5 6 7 8 9

## PERMANENT REMOVAL OF MOULD FROM SURFACES USING ALCOHOLS

CATEGORY: CHEMISTRY

TO: CSIC/MC/111

### DIFFERENTIAL VS OTHER TECHNOLOGIES



After a complete study of moulds on floors and walls in homes affected by DANA, a specific product has been designed to eliminate them and prevent their appearance. Unlike other cleaners commercially available based on sodium hypochlorite solutions (bleach), this product acts directly on the cell wall of the fungi, thus preventing their regeneration.



### APPLICATIONS AND BENEFITS

The solution consists of a mixture of alcohols and a fungicide product. The results obtained demonstrate the efficiency of the product for the elimination of different types of moulds and the permanence of the solution over time. It is a liquid product, easily applied on floors and walls by spraying. Scaling is simple

INSTITUTE: CENIM/IETCC

TRL

1 2 3 4 5 6 7 8 9

## ULTRA-FAST PRODUCTION OF FLEXIBLE SUPERCONDUCTING TAPES

CATEGORY: CHEMISTRY

TO: CSIC/AF/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Superconducting materials transport electricity without energy losses if they are below a critical temperature. This new method based on TLAG-CSD (Transient Liquid Assisted Growth Chemical Solution Deposition) allows them to be synthesized by improving the structural homogeneity of the superconducting layer, is 100 times faster than the methods currently used and has the characteristics to be considered green chemistry.



### APPLICATIONS AND BENEFITS

The method is ideal for the production of flexible superconducting tapes for magnetic resonance imaging equipment, particle accelerators, nuclear fusion reactors, etc.

INSTITUTE: ICMAB

TRL

1 2 3 4 5 6 7 8 9

## SELECTIVE PHOTOCATALYTIC OXIDATION PROCESS TO PRODUCE PHENOL IN A MORE SUSTAINABLE WAY

CATEGORY: CHEMISTRY

TO: CSIC/AF/020

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The efficient transformation of C-H bonds into more reactive functional groups is a challenge in modern chemistry. The method developed is a photocatalytic oxidation process that allows obtaining multiple end products from different starting molecules. The proof of concept is optimizing and scaling up the method for the production of phenol.



### APPLICATIONS AND BENEFITS

Easily scalable manufacturing method that does not use organic solvents. High yields can be obtained without generating by-products. Different products can be obtained with the same starting material by modifying the reaction time.

INSTITUTE: ICMAB

TRL

1 2 3 4 5 6 7 8 9



# HEALTH



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## ANTIVIRAL COMPOUND AGAINST HSV-1 AND HSV-2 ACICLOVIR RESISTANT STRAINS

CATEGORY: HEALTH

TO: CSIC/EG/133

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Currently, there is no cure for the herpes simplex virus (HSV). First-line treatments such as acyclovir can effectively relieve symptoms and reduce outbreaks, but prolonged use—especially in immunocompromised individuals—may lead to drug resistance. LN-7 emerges as a new “first-in-class” antiviral candidate effective against acyclovir-resistant HSV strains, with synergistic effects in combination therapies and prophylactic potential.



### APPLICATIONS AND BENEFITS

Thanks to its novel mode of action, inhibiting viral replication, LN-7 is suitable for treating acyclovir-resistant strains. In addition, it exhibits synergistic activity in combination therapies (90% viral inhibition) and a prophylactic antiviral effect. This makes LN-7 a strong therapeutic candidate, especially for immunocompromised patients. Its antiviral activity has been demonstrated against acyclovir-resistant HSV-1 and HSV-2 strains. Furthermore, it exhibits excellent pharmacokinetic and safety properties following oral and intravenous (i.v.) administration in rats and mice, as well as antiviral efficacy in a mouse model.

INSTITUTE: CBMSO

TRL

1 2 3 4 5 6 7 8 9

## LIGHT-REGULATED BETA BLOCKERS FOR THE TREATMENT OF OCULAR DISEASES

CATEGORY: HEALTH

TO: CSIC/XA/019

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Reversible beta-blocker antagonists regulated by visible light for localised and temporarily restricted activation of beta-adrenergic receptors in the eye, with application in the treatment of eye diseases such as glaucoma or diabetic corneal nerve sensory dysfunction. Such localised activation would minimise the possible adverse respiratory or cardiac effects observed in glaucoma patients treated with beta-blockers.



### APPLICATIONS AND BENEFITS

The light-regulated beta-blocker compounds offer a novel and highly advantageous approach compared to conventional drugs, allowing precise control over the timing, location, and intensity of the drug's action, thereby improving treatment efficacy and minimizing secondary effects. Their photochemical and pharmacological properties are ideal for the development of therapies for eye diseases, as the drug is inactive in the absence of light. Its activity has been proven in a mouse model of glaucoma.

INSTITUTE: IQAC

TRL

1 2 3 4 5 6 7 8 9

## NOVEL ETANERCEPT VARIANT WITH IMPROVED THERAPEUTICAL EFFECT

CATEGORY: HEALTH

TO: CSIC/SS/002

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Etanercept (Enbrel®) is one of the leading biologic drugs for the treatment of chronic inflammatory diseases such as rheumatoid arthritis, ankylosing spondylitis, and psoriasis, by blocking TNF. A next-generation etanercept variant is presented that strategically reshapes the interaction interface between the receptor moiety and TNF, resulting in increased TNF neutralization efficiency, improves pharmacodynamic behaviour and reduces undesired interactions with LT $\alpha$ , thereby reducing the drug's side effects.



### APPLICATIONS AND BENEFITS

Engineered through precise amino acid substitutions, this variant shows improved specificity for TNF neutralization and enhanced therapeutic efficacy, thanks to the dual inhibition of TNF and chemokines, as well as an enhanced safety profile. Studies in a mouse model of arthritis showed that the fusion protein acts equivalently to double the dose of etanercept, demonstrating greater potency per mg. Additionally, this variant exhibits a more than 60 fold reduction in anti-LT $\alpha$  activity, whilst preserving immune competence.

INSTITUTE: CBMSO

TRL

1 2 3 4 5 6 7 8 9

## NANOPARTICLES WITH A HYDROPHOBIC SUPPORT FOR DRUG DELIVERY

CATEGORY: HEALTH

TO: CSIC/RA/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Soluble and insoluble nanoparticles composed of at least one polypeptide with affinity for a hydrophobic support, which binds to a protein of interest to provide combined biological functionality and enable targeted drug delivery, increasing effectiveness, reducing required dosage, and minimizing potential side effects.



### APPLICATIONS AND BENEFITS

This innovative system offers high versatility, overcoming the need for poorly soluble affinity polypeptides or chemically modified lipids. Its applicability ranges from the development of drug delivery systems encapsulated in liposomes or extracellular vesicles and directed to specific cell types, to the production of magnetic nanoparticles with diagnostic and/or therapeutic capabilities.

INSTITUTE: CIB

TRL

1 2 3 4 5 6 7 8 9

## PEPTIDES FOR REDUCTION OF COGNITIVE IMPAIRMENT IN AGE-RELATED DISEASES

CATEGORY: HEALTH

TO: CSIC/SS/001

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Folate deficiency, with an estimated prevalence of about 30% in elderly people, is associated with an increased risk of dementia and higher mortality. Although folate supplementation is used as a treatment to reduce cognitive decline, its benefits are limited due to toxic effects, as it activates all members of the folate receptor (FR) family. The new peptides developed are exclusively selective for FR $\alpha$ , avoiding the systemic toxicity associated with high-dose folate administration.



### APPLICATIONS AND BENEFITS

These compounds induce cognitive improvement in both recognition and spatial memory on a murine model of aging. Moreover, these peptides are permeable to the blood-brain barrier, with specific binding to the neuroepithelial FR $\alpha$ , allowing for versatile routes of administration.

INSTITUTE: CBMSO

TRL

1 2 3 4 5 6 7 8 9

## PROGRAMMABLE MEDICAL DEVICE FOR PATHOLOGICAL TREMOR REDUCTION

CATEGORY: HEALTH

TO: CSIC/EG/134

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Device for treatment of pathological tremor that, unlike current treatments, is non-invasive and capable of reducing tremor consistently and safely, avoiding the side effects of direct brain stimulation. It enhances the effects of peripheral electrical stimulation to reduce tremor for more than just a few minutes after stimulation.



### APPLICATIONS AND BENEFITS

Through a wearable electronic sleeve, personalized peripheral electrical stimulation is delivered as a therapeutic intervention for tremor reduction, also enabling long-term monitoring and making it suitable for home use. The device, tested in patients with essential tremor, is effective, affordable, non-invasive, and scalable.

INSTITUTE: IC

TRL

1 2 3 4 5 6 7 8 9

## BROAD-SPECTRUM ANTIVIRALS AGAINST CORONAVIRUS AND OTHER ENVELOPED VIRUSES

CATEGORY: HEALTH

TO: CSIC/EG/136

### DIFFERENTIAL VS OTHER TECHNOLOGIES



New broad-spectrum antiviral compounds that prevent the virus from entering cells. They are easily synthesized with enzymatic catalysts under green chemistry conditions and administered nasally by inhalation. *In vitro* tests of antiviral activity and *in vivo* toxicity assays have been performed.



### APPLICATIONS AND BENEFITS

Useful for treating viral infections as such, rather than merely alleviating associated symptoms. They have shown efficacy against various enveloped viruses such as coronaviruses, herpes simplex virus or vesicular stomatitis virus.

INSTITUTE: ICP

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## PERSONALIZED ULTRASONIC NEUROMODULATION GUIDED BY LOW-FIELD MRI

CATEGORY: HEALTH

TO: CSIC/JG/012

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An integrated ultrasonic neuromodulation system with a unique architecture that combines acoustic holography and low-field resonance, enabling fully customisable, precise and cost-effective brain treatments. Unlike existing high-cost solutions, it uses custom 3D-printed holographic lenses for each brain anatomy, ensuring perfect focus. By integrating low-field MRI guidance and robotic positioning, it reduces costs while ensuring reproducibility. Additionally, it enables localized opening of the blood-brain barrier for targeted drug delivery.



### APPLICATIONS AND BENEFITS

This non-invasive neuromodulation system revolutionizes the sector by offering a low-cost alternative to current commercial MR-guided ultrasound systems. Its core advantage lies in full treatment personalization through patient-specific acoustic holograms. It is more compact than existing technologies and potentially adaptable to outpatient settings, ensuring high precision in positioning and guidance. It effectively addresses the need for advanced, accessible, and highly reproducible therapies. The system's effectiveness has been demonstrated *in vivo*.

INSTITUTE: I3M

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## ANTIBODIES FOR THE TREATMENT OF IMMUNE-MEDIATED INFLAMMATORY DISEASES

CATEGORY: HEALTH

TO: CSIC/RA/003

### DIFFERENTIAL VS OTHER TECHNOLOGIES



C5a is a peptide generated during the activation of the complement system, whose prolonged and dysregulated activity contributes to the development and exacerbation of various immune inflammatory pathologies, and can even lead to death. Single-domain antibodies or nanoantibodies (sdAbs, Nbs) capable of binding to C5a with high affinity have been developed, thereby blocking the activation of its receptors.



### APPLICATIONS AND BENEFITS

Their therapeutic applications include disorders involving leukocyte migration or activation, chronic and acute inflammation, autoimmune and inflammatory diseases, and immunopathological disorders. Currently, its therapeutic effects are being studied in mouse models of lung inflammation, cancer, geographic atrophy, and cerebral infarction. It can also be applied in diagnostics, for the detection and quantification of C5a.

INSTITUTE: CIB

TRL

1 2 3 4 5 6 7 8 9

## DESIGN OF AN ENRICHED ACOUSTIC ENVIRONMENT AS PERSONALISED SOUND THERAPY FOR TINNITUS

CATEGORY: HEALTH

TO: CSIC/MC/114

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Tinnitus is an incurable hearing disorder that can cause unpleasant and even severe effects. A personalised sound treatment called Enriched Acoustic Environment (EAE) has been developed, which can be adapted to each patient's hearing loss based on audiometric tests for each ear. It consists of exposing the patient to a combination of continuous and sequential sound stimuli for one hour a day over a period of four months. For the design of these EAE stimuli, an application and a graphical user interface have been developed, which allows for personalized application in the patient's own home.



### APPLICATIONS AND BENEFITS

This sound therapy has been tested on more than 800 tinnitus patients, with 86% of those who complete the treatment experiencing a significant improvement and reduction in their emotional symptoms. Furthermore, the equalized listening to these stimuli for one hour a day compensates for the hearing loss caused by tinnitus, and due to neuroplasticity, its effects are expected to diminish over the course of the treatment.

INSTITUTE: ITEFI

TRL

1 2 3 4 5 6 7 8 9

## SOFTWARE TOOL FOR REAL-TIME BIOMECHANICAL EVALUATION

CATEGORY: HEALTH

TO: CSIC/MC/116

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Software system designed for the real-time acquisition and processing of biomechanical signals, capable of generating automatic and immediate reports that inform the user about gait quality and daily performance. The software is independent of the type of sensor used and can interpret data from a wide variety of devices. Its graphical interface is intuitive and facilitates the visualization and understanding of the parameters analysed.



### APPLICATIONS AND BENEFITS

Thanks to its open architecture, it can be integrated into clinical environments as a tool that provides objective data to support evidence-based decision-making and select the most appropriate rehabilitation protocol. It can also be used in telemedicine contexts in users' homes, sending biomechanical reports to healthcare professionals, who can remotely assess the patient's progress.

INSTITUTE: CAR

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## COPPER-THIOUREA ANTICANCER COMPLEXES WITH ENHANCED POTENCY AND REDUCED TOXICITY

CATEGORY: HEALTH

TO: CSIC/DT/019

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Pioneering copper complexes with thiourea ligands that exhibit improved *in vivo* antitumor activity, at the same dose and route of administration, compared to other chemotherapeutic drugs currently used in clinical practice. Furthermore, they have demonstrated high specificity for tumor cells, which could lead to treatments with fewer side effects.



### APPLICATIONS AND BENEFITS

These copper-thiourea complexes have exhibited potent antitumor activity, both *in vitro* and *in vivo*, in breast and pancreatic cancer (PDAC) models, effectively reducing tumor growth, improving survival, exhibiting an acceptable toxicity profile for normal cells, and demonstrating high stability under physiological conditions. This makes them promising candidates for therapeutic applications in the treatment of various types of cancer.

INSTITUTE: ISQCH

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SUSTAINABLE AND SAFE AGRICULTURAL BIOFUNGICIDES

CATEGORY: HEALTH

TO: CSIC/ME/027

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The overproduction of antifungal proteins combined with the removal of antibiotic resistance markers positions our optimized strain of *Penicillium chrysogenum* as a safe and scalable biotechnological platform for the sustainable production of biofungicides. Compared to conventional chemical fungicides, these biofungicides provide high efficacy, straightforward extraction and purification, applicability for crop protection and during postharvest storage, and show no *in vitro* cytotoxicity in human cells.



### APPLICATIONS AND BENEFITS

The biofungicide produced by our *Penicillium chrysogenum* strain has demonstrated *in vivo* efficacy against green, blue, and gray molds, as well as rice blast disease. The robustness and scalability of the producing strain enable industrially viable production, with the potential to reduce annual economic losses by hundreds of millions of dollars while also decreasing food waste and its associated social impact.

INSTITUTE: IATA

TRL **1** 2 3 4 5 6 7 8 9

## GABA-PRODUCING *Bifidobacterium Adolescentis* STRAINS TO ALLEVIATE SYMPTOMS OF STRESS AND CHRONIC PAIN

CATEGORY: HEALTH

TO: CSIC/AH/054

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The strains have been isolated from different samples (faeces and colon content or biopsy) from several healthy individuals and are characterized by their ability to produce GABA (gamma-aminobutyric acid) from its precursor MSG (monosodium glutamate). One strains has shown capable of producing GABA in fermented milk, generating products that are naturally enriched in this neuroactive compound. In addition, the strain is able to survive gastrointestinal transit in milk and is safe for use as a culture in foods intended for human consumption.



### APPLICATIONS AND BENEFITS

Since GABA is the main inhibitory neurotransmitter of the central nervous system (CNS), its application would be aimed at reducing stress levels in both physiological and pathological conditions, as well as improving symptoms associated with chronic pain (for example, in fibromyalgia). In a mouse model, one of the strains, administered orally suspended in powdered milk, has been shown to reduce circulating MSG levels and modulate the gut microbiota. Furthermore, in aged female mice, the strain has demonstrated its ability to improve age-associated cognitive decline, as well as to enhance immune parameters and oxidative status.

INSTITUTE: IPLA

TRL **1** 2 3 4 5 6 7 8 9

## ELECTRONIC POINT-OF-CARE BIOSENSOR FOR FAST AND EASY DETECTION OF BIOMARKERS IN LIQUID BIOLOGICAL SAMPLES

CATEGORY: HEALTH

TO: CSIC/AF/023

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Current sensors that allow *in situ* the detection of biomarkers for diagnostic purposes require previously labelling of the molecule and only allow qualitative measurements. Our sensor allows label-free quantitative detection of biomarkers. This is achieved by combining an absorbent material that transports the sample to be analysed and sensor media that produce a variable electric current depending on the amount of analyte present in the sample.



### APPLICATIONS AND BENEFITS

This electronic device enables rapid on-site detection of disease biomarkers in liquid samples without the need for specialised personnel or complex procedures. Results are read by use of a potentiostat that can be connected to a mobile phone. Tested, for example, in saliva samples for the detection of hepatitis B virus.

INSTITUTE: ICMAB

TRL

1 2 3 4 5 6 7 8 9

## MINCLE AGONIST COMPOUNDS WITH IMMUNOMODULATORY ACTIVITY AS VACCINE ADJUVANTS AND AS THERAPEUTICS IN THE AREAS OF INFECTIOUS DISEASES, AUTOIMMUNITY AND CANCER

CATEGORY: HEALTH

TO: CSIC/AH/043

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The compounds are glycolipids based on thiourea and urea and have shown *in vitro* and *in vivo* immunostimulant activity. Mincle is a transmembrane C-type lectin receptor (CLR) expressed on immune system cells such as macrophages and dendritic cells. Mincle activation initiates a signalling cascade leading to an immunostimulating effect. Over the past decade, many glycolipids have been synthesized as Mincle activators. However, most of them are too reactogenic or toxic so they cannot be used as therapeutic agents.



### APPLICATIONS AND BENEFITS

The new compounds can elicit an inflammatory response both *in vitro* and *in vivo* and they represent a new class of Th1/Th17-inducing adjuvants. The incorporation of thiourea and urea connectors between the carbohydrate and the lipid moieties enables efficient and scalable preparation protocols. The immunostimulant function of the compounds has been shown *in vitro* in different human and mouse cells. Moreover, the ability of compounds to function as an adjuvant was assessed in a mouse model *in vivo*.

INSTITUTE: IIQ

TRL

1 2 3 4 5 6 7 8 9

## GLYCOLIPID MIMETIC IMMUNOMODULATORS TO PROMOTE AN ANTI-INFLAMMATORY OR ADJUVANT RESPONSE

CATEGORY: HEALTH

TO: CSIC/AH/044

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Unlike existing synthetic immunoregulatory glycolipids, the two families of glycolipid mimetic compounds developed are most metabolically stable, with simpler synthesis, and can be selectively modified to optimize their immunomodulatory profile to induce Th1- or Th2-biased immune response, depending on the context.



### APPLICATIONS AND BENEFITS

These two new families can be used for the treatment of immune diseases cursed with Th1/Th2 imbalance or as vaccine adjuvants. The compounds have shown suppression of  $\alpha$ -GalCer- or LPS-induced inflammation *in vitro* and *in vivo*. Their ability to suppress Th2-type inflammation and the adjuvant capacity of some compounds have also been confirmed in a mouse model *in vivo*.

INSTITUTE: IIQ

TRL

1 2 3 4 5 6 7 8 9

## NANOSTRUCTURED LIPID CARRIERS TO PREVENT OR TREAT THE FORMATION OF BACTERIAL BIOFILMS

CATEGORY: HEALTH

TO: CSIC/AH/046

### DIFFERENTIAL VS OTHER TECHNOLOGIES



There is a need for treatments to prevent the formation of biofilms of pathogenic bacteria. The nanolipid carriers developed are made up of a lipid core composed of a mixture of solid and liquid lipids and a shell consisting of a layer of surfactant that allows their stabilization in water. They are more stable than other lipid nanosystems (emulsions or vesicles), do not produce a bactericidal effect and the formulations are versatile, which allows their anti-biofilm effect to be optimized against a broad spectrum of bacterial strains.



### APPLICATIONS AND BENEFITS

The presence of bacterial biofilms is associated with the chronicity of different mucosal infections, infections associated with prosthetic implants, and recurrent respiratory infections associated with other pathologies, such as chronic obstructive pulmonary disease (COPD) and cystic fibrosis. These nanocarriers have been shown to inhibit the formation of biofilms of non-typeable *H. influenzae* (in clinical strains isolated from patients with COPD), of *P. aeruginosa* and of *C. violaceum*. The inhibitory effect of bacterial biofilms has also been demonstrated in an *ex vivo* porcine lung model.

INSTITUTE: IQM

TRL

1 2 3 4 5 6 7 8 9

## BIOMARKER FOR DIAGNOSIS AND PROGNOSIS OF MULTIPLE SCLEROSIS

CATEGORY: HEALTH

TO: CSIC/EG/132

### DIFFERENTIAL VS OTHER TECHNOLOGIES



It is crucial to have biomarkers to detect the transition to the Progression of Multiple Sclerosis (MS) stage and help monitor its evolution using a simple, minimally invasive and effective method. TAF1 biomarker, unlike other MS biomarkers, is related to the pathogenesis of the disease, allowing monitoring the response to treatments aimed at correcting the TAF1 alteration.



### APPLICATIONS AND BENEFITS

A simple, rapid and minimally invasive diagnostic tool that, by means of a blood or cerebrospinal fluid sample, can predict the transition to progressive MS, allowing treatment adjustment in an optimal time frame. In addition to its diagnostic and prognostic potential, it offers the added value of being used as a marker of response to possible treatments based on the correction of the TAF1 alteration.

INSTITUTE: CBMSO

TRL

1 2 3 4 5 6 7 8 9

## MACTIDE-V, AN EFFICIENT PEPTIDE-DRUG-CONJUGATE IN TRIPLE-NEGATIVE BREAST CANCER TREATMENT

CATEGORY: HEALTH

TO: CSIC/IM/079

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Metastatic breast cancer has no current effective therapy, thus requiring development of new chemo and immunotherapeutic agents. MACTIDE-V is a novel peptide-drug conjugate able to modulate macrophage function and activate cytotoxic lymphocytes and NK cells, for an effective triple-negative breast cancer treatment.



### APPLICATIONS AND BENEFITS

MACTIDE-V is able to modulate the phenotype of CD206+ tumour associated macrophages allowing to slow tumour progression, significantly reduce the tumour volume and suppress lung metastasis, in different triple-negative breast cancer mouse models, orally administered. In addition, MACTIDE linked to a detectable agent, could potentially be used to target lymph nodes for diagnosis even before the tumour occurrence.

INSTITUTE: IQAC

TRL

1 2 3 4 5 6 7 8 9

## NOVEL TYPE OF PROTACS DIRECTLY TARGETING THE PROTEASOME FOR CANCER TREATMENT

CATEGORY: HEALTH

TO: CSIC/IM/080

### DIFFERENTIAL VS OTHER TECHNOLOGIES



These novel proteolytic set of chimeras (26STACs) direct the degradation by the proteasome of the ceramide transfer protein CERT-1, which may play a relevant role as enhancer of anti-cancer treatments, such as chemotherapy. These chimeras target directly the 26S proteasome in an E3 ubiquitin ligase independent manner, in contrast to the mechanism of action in most PROTACs, thus avoiding ubiquitination dependence on the degradative action of the proteasome, increasing its efficiency.



### APPLICATIONS AND BENEFITS

This approach is envisaged as a good strategy for targeting crucial proteins for cancer therapy. CERT-1 degradation has been tested in three types of human breast cancer cell lines (from metastatic carcinoma, TNBC and a ductal carcinoma) showing potent degradation and proper permeability and toxicity profiles.

INSTITUTE: IBMB/IQAC

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## COMPOUND DERIVED FROM THE CONJUGATION OF FATTY ACIDS AND AMINO ACIDS AS NEURONAL PROTECTOR AGAINST NEURODEGENERATIVE DISEASES

CATEGORY: HEALTH

TO: CSIC/ME/024

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Neurodegenerative diseases such as Alzheimer's and Parkinson's are a challenge for medicine today, as there are no effective treatments available that can modify the progression and evolution of these diseases. A conjugate of fatty acids and amino acids has been developed that protects neurons and facilitates the elimination of the protein aggregates that cause the most common neurodegenerative diseases, which opens up the possibility of new, more effective and low-cost treatments.



### APPLICATIONS AND BENEFITS

The fatty acid-amino acid conjugate protects neurons from the protein aggregates that cause these diseases, helping to eliminate them and restore normal neuronal activity. In addition, it is a molecule of biological origin, with no observed toxicity or side effects, easy and cheap to synthesize, with proven effectiveness *in vitro* and *in vivo* against neuronal degeneration and with the possibility of being used both in clinical treatments and in preventive food supplements.

INSTITUTE: IN

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## GLUTEN DEGRADING PROTEIN FOR THE PREVENTION OF CELIAC DISEASE

CATEGORY: HEALTH

TO: CSIC/XA/013

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Celiac disease is caused by partially degraded gluten peptides that trigger a pro-inflammatory autoimmune response. A recombinant protein, derived from a naturally occurring one, has been developed, which is able to degrade these immunogenic peptides, thus preventing or reducing the inflammatory response. This protein remains stable and active in the strongly acidic gastric environment and resists digestive enzymes, as well as being stable under ambient conditions.



### APPLICATIONS AND BENEFITS

This protein may have applications as a food supplement as well as in the food industry for the manufacture of gluten-free products. In gliadin degradation assays in an animal model of coeliac disease, it performed significantly better in terms of reducing the amount of toxic peptide, even at low doses, compared to another endopeptidase with glutenase activity.

INSTITUTE: IBMB

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## LIGHT-REGULATED COMPOUNDS FOR LOCAL AND TEMPORALLY ACTIVATION OF THE VITAMIN D RECEPTOR

CATEGORY: HEALTH

TO: CSIC/XA/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Light-regulated reversible agonist compounds that can selectively activate the vitamin D receptor (VDR) for the treatment of diseases in which the function of this receptor is altered, e.g. cancer and autoimmune diseases, such as psoriasis. These compounds can be selectively activated with light at different wavelengths, at the required time and site of action, avoiding the development of side effects in other tissues or even at the systemic level.



### APPLICATIONS AND BENEFITS

Light-directed control of the activity of these compounds allows modulation of their affinity and efficacy targeting VDR activity at the localization of the pathology. Activating the compounds by local illumination with visible blue light has been shown to produce robust anti-inflammatory responses in a mouse model of psoriasis, with complete antipsoriatic activity.

INSTITUTE: IQAC

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**



# FOOD TECHNOLOGY



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



BIOTECHNOLOGY



ELECTRONICS



ENERGY



HUMANITIES AND  
SOCIAL SCIENCES



MATERIALS



ENVIRONMENT



CHEMISTRY



HEALTH



FOOD TECHNOLOGY



INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## VEGETAL OIL OLEOGELS TO SUBSTITUTE SOLID FATS

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/ME/029

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Production of oleogels made from vegetable oils (olive, sunflower, rapeseed, etc.) using all-natural gelling agents derived from legumes, avoiding the chemical processing typically used in other products, such as margarine. This results in a solid rich in unsaturated fats, which is also produced via a simple and easily scalable process.



### APPLICATIONS AND BENEFITS

These oleogels, rich in insaturate fats, can be used in the food industry as a substitute for butter and solid fats, as its texture allows it to be spreadable. It is of particular interest in bakery and pastry making, because their properties make them healthier than saturated fats. They have been tested in complex food matrices, replacing 100% of conventional fats. Tested in tasting sessions, yielding very positive results in terms of acceptance and satisfaction.

INSTITUTE: IATA

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SUSTAINABLE BIOMASS OF HEDISTE DIVERSICOLOR AS A NATURAL SOURCE OF OMEGA-3

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/CJ/022

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Protocol optimised for the intensive and controlled cultivation of Hediste diversicolor, including sustainable production techniques with low environmental impact and efficient biomass harvesting for various aquaculture and biotechnology applications. The result is a raw material rich in omega-3 lipids, which is of great interest to the aquaculture and biotechnology sectors.



### APPLICATIONS AND BENEFITS

The system integrates production techniques with low environmental impact, high reproductive efficiency and water quality control, ensuring a stable process that can be transferred to productive environments. The biomass obtained is rich in omega-3 lipids, making it a high-value raw material for aquaculture. The species is also used as fishing bait and is suitable for integrated multitrophic aquaculture (IMTA) and circular economy projects.

INSTITUTE: IEO

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## GABA-PRODUCING *Bifidobacterium Adolescentis* STRAINS TO ALLEVIATE SYMPTOMS OF STRESS AND CHRONIC PAIN

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/AH/054

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The strains have been isolated from different samples (faeces and colon content or biopsy) from several healthy individuals and are characterized by their ability to produce GABA (gamma-aminobutyric acid) from its precursor MSG (monosodium glutamate). One strains has shown capable of producing GABA in fermented milk, generating products that are naturally enriched in this neuroactive compound. In addition, the strain is able to survive gastrointestinal transit in milk and is safe for use as a culture in foods intended for human consumption.



### APPLICATIONS AND BENEFITS

Since GABA is the main inhibitory neurotransmitter of the central nervous system (CNS), its application would be aimed at reducing stress levels in both physiological and pathological conditions, as well as improving symptoms associated with chronic pain (for example, in fibromyalgia). In a mouse model, one of the strains, administered orally suspended in powdered milk, has been shown to reduce circulating MSG levels and modulate the gut microbiota. Furthermore, in aged female mice, the strain has demonstrated its ability to improve age-associated cognitive decline, as well as to enhance immune parameters and oxidative status.

INSTITUTE: IPLA

TRL

1 2 3 4 5 6 7 8 9

## GENE CONSTRUCTS FOR THE PRODUCTION OF HETEROLOGOUS PROTEINS OF INTEREST

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/RA/004

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The use of specific gene constructs that enable the expression and production of high concentrations of heterologous target proteins in filamentous fungi, tailored to the needs of industrial protein manufacturing. By cultivating cells into which these sequences have been introduced and increasing the pH of the culture medium, the expression and high-level production of the desired proteins or polypeptides are induced without the need for inducers that could cause significant alterations to cellular metabolism.



### APPLICATIONS AND BENEFITS

It is a fast method compatible with high ammonium levels, allowing the co-expression of two different proteins within the same host cell and the use of complex media based on low-cost carbon and nitrogen sources. Because expression is induced by increasing the pH, pellet formation is avoided, reducing the energy required to agitate the medium in the fermenter. It is therefore a revolutionary and cost-effective method.

INSTITUTE: CIB

TRL

1 2 3 4 5 6 7 8 9

## RIBOFLAVIN-PRODUCING *Bifidobacterium longum subsp. infantis* STRAINS

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/AH/055

### DIFFERENTIAL VS OTHER TECHNOLOGIES



*Bifidobacterium longum subsp. infantis* strains obtained through evolutionary adaptation with roseoflavin (a riboflavin analog), identifying mutations that increase riboflavin production. Their potential to ferment milk and an almond-based plant beverage in the presence of oxygen was evaluated showing, by HPLC analysis, that riboflavin levels are higher in milk and exceed those of commercial yogurts. Additionally, these strains exhibit high survival after *in vitro* simulated digestion, suggesting *in situ* vitamin production in the colon.



### APPLICATIONS AND BENEFITS

The main application of these strains is the development of probiotic foods, such as fermented milk products, for specific population with higher requirements for this vitamin, such as children, pregnant women, older adults and athletes.

INSTITUTE: IPLA

TRL 1 2 3 4 5 6 7 8 9

## SUSTAINABLE AND SAFE AGRICULTURAL BIOFUNGICIDES

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/ME/027

### DIFFERENTIAL VS OTHER TECHNOLOGIES



The overproduction of antifungal proteins combined with the removal of antibiotic resistance markers positions our optimized strain of *Penicillium chrysogenum* as a safe and scalable biotechnological platform for the sustainable production of biofungicides. Compared to conventional chemical fungicides, these biofungicides provide high efficacy, straightforward extraction and purification, applicability for crop protection and during postharvest storage, and show no *in vitro* cytotoxicity in human cells.



### APPLICATIONS AND BENEFITS

The biofungicide produced by our *Penicillium chrysogenum* strain has demonstrated *in vivo* efficacy against green, blue, and gray molds, as well as rice blast disease. The robustness and scalability of the producing strain enable industrially viable production, with the potential to reduce annual economic losses by hundreds of millions of dollars while also decreasing food waste and its associated social impact.

INSTITUTE: IATA

TRL 1 2 3 4 5 6 7 8 9

## ENZYMATIC BIOTECHNOLOGY: ADVANCED MATAIRESINOL PRODUCTION

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/RR/008

### DIFFERENTIAL VS OTHER TECHNOLOGIES



This enzymatic method for matairesinol production represents a significant advancement in biotechnology applied to nutrition and health. Unlike traditional methods, this technology uses a combination of highly efficient enzymes that optimize the conversion of secoisolariciresinol diglucoside (SDG) into matairesinol. This innovation not only increases reaction yield (over 70%) but also enables a more sustainable and cost-effective process without the need for additional external cofactors.



### APPLICATIONS AND BENEFITS

Matairesinol and other lignans hold high value in the food and health sectors due to their anticancer, antioxidant, and antiproliferative properties. The technology has been tested in the field of food biotechnology, demonstrating its effectiveness in the efficient production of these bioactive compounds, without the use of aggressive chemical processes, making it safe for use in food products. This innovation opens new opportunities for the development of functional foods and supplements with health benefits, marking a milestone in the sustainable production of bioactive compounds.

INSTITUTE: INIA

TRL **1** 2 3 4 5 6 7 8 9

## PROCESS FOR BLOOD REVALORIZATION TO GENERATE AN ANIMAL FEED PRODUCT WITH HIGH ADDED VALUE

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/ME/031

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Most of the blood from slaughterhouses is a waste management problem for this type of industry. This residual blood contains a large amount of components of interest and, therefore, can be used as raw material to generate products with high added value. To revalue the blood, hydrolysis processes are used to obtain peptides and amino acids. Chemical hydrolysis is currently used, but this process is not sustainable. This new enzymatic hydrolysis process makes it possible to obtain peptides that can be used as animal food additives with very beneficial properties.



### APPLICATIONS AND BENEFITS

The peptides obtained by the new enzymatic hydrolysis method present characteristics that make them interesting to be used in animal feed, especially in the fish farming industry. They have been shown to promote growth rate, increase swimming performance and allow the prevention and/or treatment of stress and behavioural disorders of the subjects. Similarly, the bioactive peptides generated show antioxidant, anti-inflammatory, hypoglycaemic and immunomodulatory activity. Therefore, the new hydrolysate can be used in different food and pharmaceutical applications.

INSTITUTE: IATA/IATS

TRL **1** 2 3 4 5 6 7 8 9

## COMPOUND DERIVED FROM THE CONJUGATION OF FATTY ACIDS AND AMINO ACIDS AS NEURONAL PROTECTOR AGAINST NEURODEGENERATIVE DISEASES

CATEGORY: FOOD TECHNOLOGY

TO: CSIC/ME/024

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Neurodegenerative diseases such as Alzheimer's and Parkinson's are a challenge for medicine today, as there are no effective treatments available that can modify the progression and evolution of these diseases. A conjugate of fatty acids and amino acids has been developed that protects neurons and facilitates the elimination of the protein aggregates that cause the most common neurodegenerative diseases, which opens up the possibility of new, more effective and low-cost treatments.



### APPLICATIONS AND BENEFITS

The fatty acid-amino acid conjugate protects neurons from the protein aggregates that cause these diseases, helping to eliminate them and restore normal neuronal activity. In addition, it is a molecule of biological origin, with no observed toxicity or side effects, easy and cheap to synthesize, with proven effectiveness *in vitro* and *in vivo* against neuronal degeneration and with the possibility of being used both in clinical treatments and in preventive food supplements.

INSTITUTE: IN

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**



# INFORMATION AND COMMUNICATION TECHNOLOGY



AGRICULTURE, LIVESTOCK  
AND MARINE SCIENCE



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INFORMATION AND  
COMMUNICATION  
TECHNOLOGY

## ROBOTIC GRIPPER FOR GRASPING AND OPENING STERILE MEDICAL BAGS

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/IG/149

### DIFFERENTIAL VS OTHER TECHNOLOGIES



A robotic gripper that stands out for completely automating the opening of sterile medical bags, a repetitive task that is performed hundreds of times per shift in hospitals and often causes musculoskeletal injuries in health staff. Its specialized clamp separates flaps, firmly holds the material, and opens the seal, ensuring aseptic conditions. It replaces unergonomic manual processes and offers a more precise, efficient, and reliable solution than conventional alternatives.



### APPLICATIONS AND BENEFITS

The system is designed for clinical environments where numerous sterile bags are handled on a daily basis, such as operating rooms and high-turnover hospital areas. It automates the presentation of contents, improves staff ergonomics, and optimizes workflow by reducing physical effort and preparation times. It maintains the sterility of the process, reduces risks associated with the constant repetition of these tasks, and provides direct support to nurses and surgical teams.

INSTITUTE: IRII

TRL **1** 2 3 4 5 6 7 8 9

## SMART MOBILITY: PEDESTRIAN ROUTES THAT MINIMIZE EXPOSURE TO POLLUTANTS

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/VC/041

### DIFFERENTIAL VS OTHER TECHNOLOGIES



An algorithm that combines air quality data from various sources to improve real-time travel and recommends "green" routes for pedestrians, optimized to minimize exposure to air pollutants. Current pedestrian navigation systems prioritize the shortest route, without considering exposure to air pollutants such as NO<sub>2</sub>, PM2.5, or PM10.



### APPLICATIONS AND BENEFITS

The system is based on an advanced hybrid algorithm that improves the accuracy of recommendations compared to conventional methods. It is transferable and scalable, with a design adaptable to other cities and urban contexts with available AQI data. Its focus on health and urban sustainability aligns with public health policies, smart cities, and responsible urban mobility, facilitating institutional adoption and public-private partnerships.

INSTITUTE: IIIA

TRL **1** 2 3 4 5 6 7 8 9

## ADVANCED GEOREFERENCED UNDERWATER VIDEO ANALYSIS SYSTEM

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/CJ/024

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Underwater video analysis tool enabling precise, georeferenced annotation of species and relevant elements. It integrates and organizes all information collected during dives into a structured geodatabase, simplifying its retrieval, traceability, and subsequent technical processing.



### APPLICATIONS AND BENEFITS

It significantly reduces the time required for underwater video analysis. It enables precise, georeferenced annotation of species and relevant elements, organizes biological, ecological, and impact data into a single geodatabase, and streamlines the review and editing of recorded information. It also facilitates the generation of lists and queries using structured filters, while integrating georeferenced photographs and associated sample catalogues.

INSTITUTE: IEO

TRL **1** 2 3 4 5 6 7 8 9

## INTELLIGENT TRAINING PATH PLANNING FOR PROFESSIONAL SKILLS DEVELOPMENT

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/VC/042

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Intelligent system for planning training itineraries, capable of recommending to each user the optimal combination of courses or modules that maximize the correspondence between their learning and the desired professional skills ("job affinity").



### APPLICATIONS AND BENEFITS

The tool optimizes course and program selection based on each individual's career goals. It generates learning pathways that maximize the acquisition of key skills for a specific position or sector. Adaptable to any institution or training platform, it facilitates the design of curricula more aligned with the real demands of the job market, in accordance with the 2030 Sustainable Development Goals (Quality Education).

INSTITUTE: IIIA

TRL **1** 2 3 4 5 6 7 8 9

## SOFTWARE TOOL FOR REAL-TIME BIOMECHANICAL EVALUATION

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/MC/116

### DIFFERENTIAL VS OTHER TECHNOLOGIES



Software system designed for the real-time acquisition and processing of biomechanical signals, capable of generating automatic and immediate reports that inform the user about gait quality and daily performance. The software is independent of the type of sensor used and can interpret data from a wide variety of devices. Its graphical interface is intuitive and facilitates the visualization and understanding of the parameters analysed.



### APPLICATIONS AND BENEFITS

Thanks to its open architecture, it can be integrated into clinical environments as a tool that provides objective data to support evidence-based decision-making and select the most appropriate rehabilitation protocol. It can also be used in telemedicine contexts in users' homes, sending biomechanical reports to healthcare professionals, who can remotely assess the patient's progress.

INSTITUTE: CAR

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**

## SIMZEBRA: A SOFTWARE FOR ZEBRA MUSSELS DETECTION IN PRESSURIZED NETWORKS

CATEGORY: INFORMATION AND COMMUNICATION TECHNOLOGY

TO: CSIC/AP/016

### DIFFERENTIAL VS OTHER TECHNOLOGIES



SIMZEBRA offers a clear visualization of zebra mussels infestation levels through customizable maps, generated for user-defined time intervals. Operating remotely on a cloud server, SIMZEBRA makes it easy to use without the need for advanced local computing resources. Unlike other traditional methods, which require costly physical inspections and continuous manual analysis, SIMZEBRA automates the infestation detection process. It is an efficient, scalable and easy-to-implement tool.

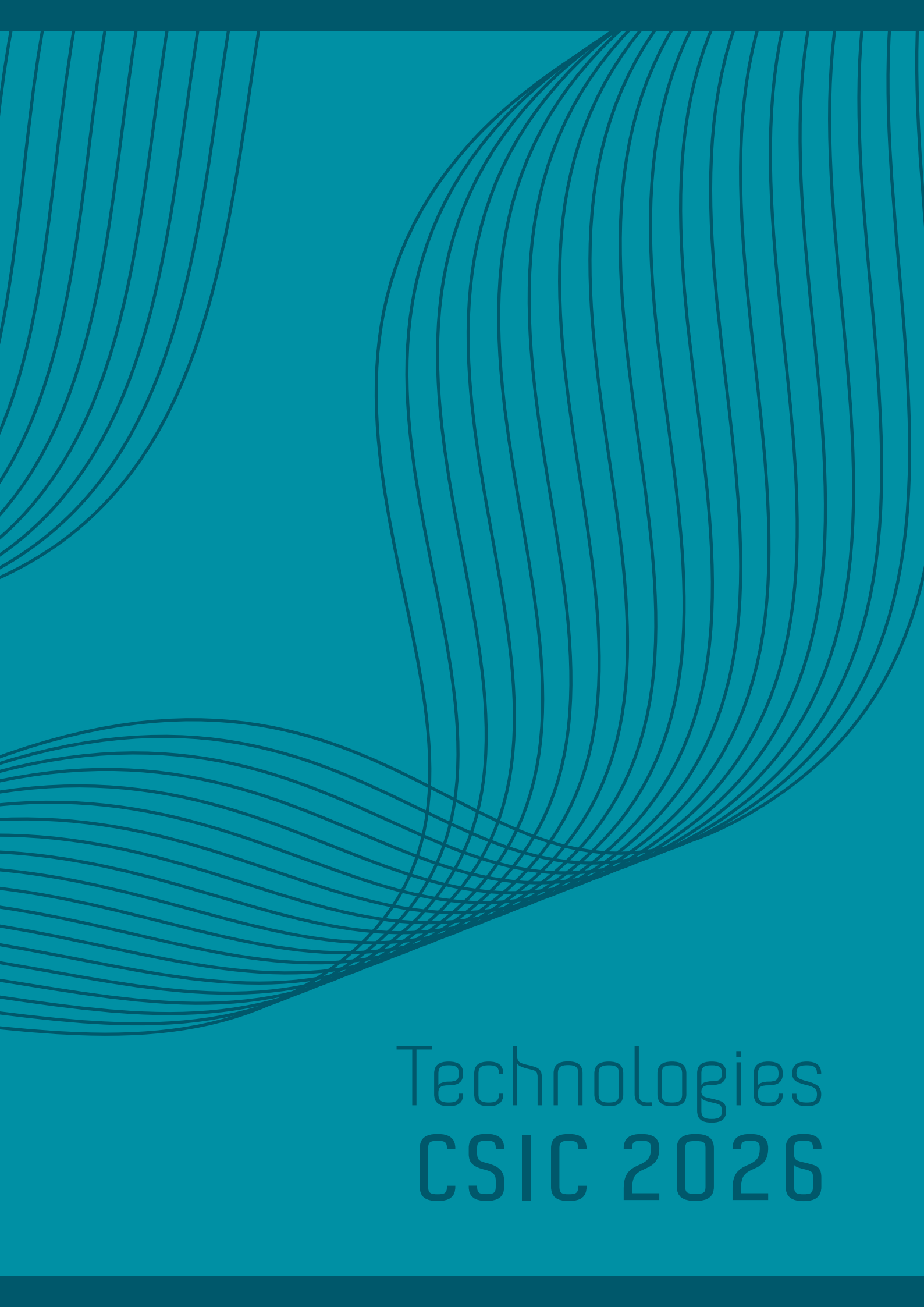


### APPLICATIONS AND BENEFITS

It allows for early detection of infestations and in specific segments of the network. Its integration with telemetry systems could provide real-time updates on the status of the network. Enables the analysis of the effectiveness of chemical or mechanical treatments for zebra mussel control. It can model different levels of infestation and their consequences on the network to anticipate problems and optimize responses. Applicable to other invasive species.

INSTITUTE: EAD

TRL **1** **2** **3** **4** **5** **6** **7** **8** **9**



# Technologies

## CSIC 2026



MINISTERIO  
DE CIENCIA, INNOVACIÓN  
Y UNIVERSIDADES



**CSIC**  
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS