BioEnredados

Uniendo Ciencia y Vida

Second Season - Volume 1

A production of:

CIC bioGUNE

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

EPISODES

Welcome to our podcast BioEnredados: Uniendo Ciencia y Vida!

We are your gateway to the cutting-edge research in biosciences that is taking place at the heart of CIC bioGUNE.

In each episode, we will immerse you in an exciting journey through the most innovative scientific and technological advances that are transforming our understanding of the biosciences, from basic chemistry to biology and medicine.

Our mission is clear: to bring you science in an accessible and exciting way. We aim to ignite your curiosity and nurture your interest in cutting-edge bioscientific research.

Are you ready?

FROM PROTEINS TO THERAPIES

PROTEOMICS IN THE MEDICINE OF THE FUTURE

When we hear the word “proteins,” we often think of nutrition: protein shakes, balanced diets, and fitness plans. But behind this common understanding lies a much deeper, more fascinating story. Proteins are not just nutrients; they are the essential workers that keep our bodies alive and functioning.

Imagine the human body as a vast and intricate city. The genome, our complete set of DNA, acts as the city’s blueprint, carefully outlining what needs to be built and how everything should operate. But it’s the proteome, the full collection of proteins in our body, that truly brings this city to life. Proteins are like the city’s workers: building structures, delivering messages, managing traffic, and keeping systems running smoothly.

In this article, we dive into the world ofproteomics, the science dedicated to studying these proteins and understanding how they interact. Thanks to powerful new technologies, scientists can now observe thousands of proteins at once, offering a clearer picture of how our bodies respond to health and disease.

To help us answer these questions, we speak with Dr. **Félix Elortza**, head of the Proteomics Platform at CIC bioGUNE and president of the Spanish Proteomics Society. Together, we explore how this fast-moving field is helping us understand the body in a whole new way.

What exactly are proteins, and why are they so essential to the human body?

- Proteins are, in a way, the workers of our cells. To help people visualize this, imagine our body as the world. Just as the world has continents, which are divided into countries, our body has different systems, like the cardiovascular or musculoskeletal system. Within those systems are cells, which you can think of as cities. And inside those cities, proteins are the specialized workers carrying out very specific tasks that keep everything running.

As mentioned, when most people hear the word “protein,” they immediately think of food, like a steak from a local grill. And it’s true, our muscles are full of protein. Those are structural proteins, like the ones found in our hair or nails, and some also help with movement and contraction, allowing us to perform physical tasks. But beyond that, there are countless tiny molecular machines, proteins of all shapes and sizes, each with a different job, working constantly to keep our bodies functioning properly.

What exactly is proteomics, and what kind of useful information can it reveal about our bodies?

- Proteomics is the scientific discipline focused on studying all the proteins present in a cell, tissue, organ, or even an entire organism. It’s a complex task, as we’re dealing with thousands of proteins that vary depending on the cell type or its health status.

Right: Freepik. Hong kong traffic view by Fanjianhua

Essentially, proteomics uses advanced technologies to create a sort of "snapshot" of all the proteins in a sample, identifying not only which proteins are present, but also how many there are. One of the most widely used methods for this is mass spectrometry combined with chromatography.

The process involves extracting proteins from cells or bodily fluids and breaking them down into smaller fragments using enzymes similar to those in our digestive system. These fragments are then separated and analyzed with highly sensitive instruments that can detect and identify them. From this data, scientists can determine the types and quantities of proteins, as well as gain insights into the molecular processes occurring inside cells, information that is key for understanding health and disease.

What unique advantages does proteomic analysis offer for understanding diseases and developing treatments?

- One key advantage of proteomics is that the proteome, the full set of proteins, is not only complex but also highly dynamic. Unlike the genome, which is relatively fixed, the proteome can change depending on the stage of development or the condition of the organism. For example, during metamorphosis, a frog or butterfly expresses different proteins at different stages, even though the genome remains the same. Proteomics helps us understand how gene expression changes over time and in different contexts.

Additionally, proteins themselves can be modified, like workers equipped with different tools. A protein might have a "wrench" or a "hammer," which changes what function it performs. Mass spectrometry allows us to detect these modifications.

"The proteome is dynamic and complex, changing with health and disease. Advances enable rapid detection of thousands of proteins, enhancing diagnosis and medicine."

So, even if two cells have the same number of a certain protein, the modified version in one cell might not be functional, which is crucial for understanding disease.

Proteomics also reveals how proteins interact, forming complexes that work together or changing partners depending on the situation. This detailed view helps us understand how biological systems function and where things go wrong. Ultimately, this knowledge guides the development of targeted therapies by showing where and how to fix the system when disease occurs.

What challenges and opportunities does proteomics face in medical research, and how are they being addressed?

- Proteomics faces significant challenges due to the complexity and dynamic nature of the proteome. Unlike the genome, which is relatively constant, the proteome changes throughout life and in different health conditions. Our bodies express thousands of proteins at varying levels, some abundant like workers on a construction site, others rare like specialized architects—and detecting all of them accurately is difficult.

Despite these challenges, advances in technology have dramatically improved proteomics. What once took a week to detect a few hundred proteins can now identify thousands in just days. This progress allows scientists to better understand diseases by analyzing proteins in well-characterized patient samples from biobanks, helping with early diagnosis and treatment.

Another exciting opportunity lies in combining proteomics with big data and AI to spot patterns across thousands of samples, enabling personalized medicine. By identifying specific protein targets, doctors can tailor treatments more precisely.

In short, proteomics offers unique insights beyond genetics, revealing how proteins function and interact in health and disease, and while challenges remain, ongoing research is paving the way for improved diagnostics and therapies.

Right, up: Félix Elortza, below: podcast episode cover.

REGULATING IMMUNE DEFENSE

THE HIDDEN ROLE OF GLYCANS

Glycans, tiny sugar molecules that quietly shape the way our immune system works, are some of the most surprising players in the body's defense strategy. Often overlooked, these microscopic structures are essential for maintaining immune balance, helping us fight threats without harming our own body.

Like secret codes on the surface of cells, they are read by specialized immune receptors that interpret what kind of response is needed. Among these receptors, there's a fascinating family called Siglecs, molecules that recognize sialic acids, a type of glycan found on many cells, including those of tumors.

What makes this so interesting is that some cancer cells seem to hijack this system. By displaying certain glycans, they trick Siglecs into silencing the immune response, allowing the tumor to grow unnoticed. It's like putting on an invisibility cloak right in front of our immune defenses. But this story doesn't end there. Glycans are also essential in fine-tuning antibodies, those powerful proteins that identify and neutralize invaders. Through a process called glycosylation, these sugar chains can change the way antibodies function, boosting or adjusting their activity depending on the body's needs. But, what if we could block this interaction and wake up our defenses again? Could this lead to new ways of treating cancer more effectively?

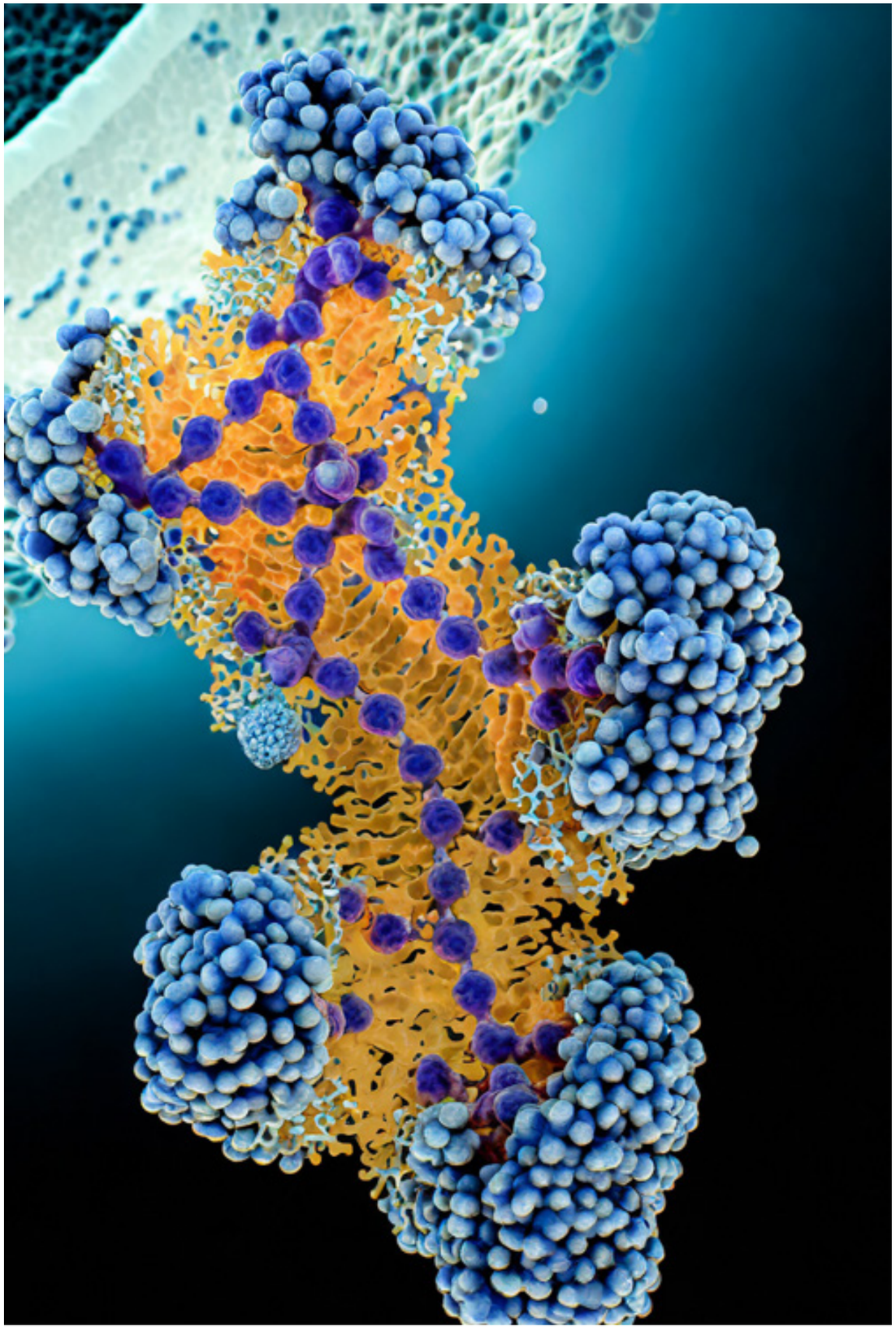
To explore these questions, we've invited Dr. **June Ereño-Orbea**, Ikerbasque researcher and principal investigator of the Cancer Glycoimmunology Group at CIC bioGUNE. With her guidance, we'll uncover how sugars may hold the key to powerful new immunotherapies.

Could you explain what glycan receptors are and how they interact with glycans? Also, why are they important for regulating the immune system?

- Well, glycans, commonly known as sugars or carbs, are really important for communication between the immune system and our cells. They act like ID cards on the cell surface that the immune system reads to figure out what's part of the body and what's not.

Every cell has a unique glycan profile, and this can change, especially in diseases like cancer, where altered glycans help tumor cells grow and spread. That's where lectins come in, they're special receptors that recognize those glycans.

These lectins are key because they decide things like whether cells stick together or if the immune response will be inflammatory or not. So, that receptor identifying glycans is crucial to understanding what's going on at the cell surface, you know? And we know, and it's been proven, that these changes play a key role in cancer progression and metastasis. So, the immune system, which works like a defense army, has evolved to recognize those glycans as markers to tell healthy cells apart from the bad ones. In this process, lectins,



Right: Generated by AI, using Adobe Firefly.

like Siglecs, detect and respond to all these different glycosylation patterns. All this is crucial for keeping us healthy and for how symptoms develop.

Regarding Siglecs, how does the interaction between these receptors and sialic acids affect cancer's capacity to evade the immune system?

- Think of cell surface glycans as a dense forest, with sialic acids as the leaves most exposed to sunlight, these are the first molecules the immune system encounters, mainly detected by Siglecs.

Humans have 16 different Siglecs, each expressed on specific immune cells and designed to recognize particular sialic acid types. Depending on the Siglec and cellular context, they can suppress immune responses, creating immune tolerance.

This is important to prevent overactive immunity but can be exploited by tumor cells to evade immune attack by creating a more "comfortable" environment.

In cancer, tumor cells often show high or altered sialic acid levels. Some Siglecs, like Siglec-9 in pancreatic cancer, suppress immune cell activity, helping tumors avoid immune destruction and grow. Because of this, Siglecs are now seen as key immune checkpoint receptors and important therapeutic targets. Understanding these interactions can help us intervene to stop tumors from manipulating the immune system.

And if we focus on the research you and your group are doing, what are the main challenges and advances in blocking this interaction to improve immuno-oncology therapies?

"Since each cancer has a unique glycan profile, it's like solving a puzzle. We use a multidisciplinary approach to better understand immune evasion and develop targeted therapies."

- Our group focuses on developing new immunotherapy techniques. Immunotherapy boosts the immune system to fight cancer using methods like checkpoint inhibitors, T cell therapies, and monoclonal antibodies. However, tumor resistance remains a major challenge.

Research is exploring ways to overcome this, including targeting the Siglec-sialic acid axis. Blocking this interaction could help the immune system better recognize and attack tumors. We're developing monoclonal antibodies alongside other groups and pharmaceutical companies to block Siglecs and disrupt tumor evasion.

Still, challenges persist, such as combining therapies effectively and understanding potential side effects.

Finally, June, how do you think advances in understanding glycans and Siglecs could transform the current approach to cancer treatment in the coming years?

- Well, right now one of the key steps is validating whether the Siglec–sialic acid axis truly represents a therapeutic target in specific cancers. First, we need to classify which Siglecs are pro- or anti-inflammatory. Those that promote an anti-inflammatory response could create an environment that supports tumor growth. Our group is actively researching which Siglecs play that role.

Another important aspect is identifying what these Siglecs are binding to, their ligands. That could reveal new therapeutic targets. Advances in techniques like mass spectrometry are helping us identify these ligands, which are often complex glycans attached to proteins or lipids.

If we can fully map out both the Siglecs and their ligands, down to the atomic-level interactions, we could rationally design better molecules to block them. Genetic and chemical engineering may also allow us to modify the glycosylation patterns of tumor cells. Since each cancer type likely has a unique glycan profile, it's a highly specific "puzzle piece" scenario, so this work is very multidisciplinary. We combine experimental biology, structural biology, and computational tools, including AI, to understand immune evasion and design more targeted therapies.

Right, up: June Ereño-Orbea, below: podcast episode cover.

THE DNA OF A PIONEER

CELEBRATING MARGARITA SALAS

Forensic science has taken a giant leap forward thanks to biochemical techniques, turning tiny traces of DNA into vital clues that help solve crimes. At the heart of this revolution is the ability to amplify genetic material, and one of the most transformative tools for doing this is the polymerase chain reaction, or PCR. This method allows scientists to make millions of copies of specific regions of DNA, even from the smallest sample, making it possible to identify individuals with extraordinary precision.

But here's something important: while PCR often grabs the spotlight, it's not the whole story, and it's not the invention of the scientist we're focusing on today. PCR was developed earlier and is used when we already know what we're looking for, such as detecting a virus like SARS-CoV-2. The work of Margarita Salas goes beyond this. Her discovery allowed scientists to study and amplify entire genomes, opening the door to breakthroughs in forensic science, paternity testing, and beyond.

Margarita Salas, born in 1938 in Canero, Asturias, was a pioneering Spanish biochemist whose research changed the way we understand and use DNA. Her discovery of the phi29 DNA polymerase became a game-changer, not just in research labs, but in practical fields like medicine and criminal investigation.

This November, as we mark both her birth and her passing, we take a closer look at the science behind Margarita's lasting legacy, and why her work continues to shape the world today.

To delve into this fascinating topic, we have the expertise of Dr. **Carlos D. Ordóñez Cencerrado,** postdoctoral researcher in the Synthetic Biology Group at CIC bioGUNE. Together, we'll dive into the molecular world Margarita helped illuminate, and discover why her legacy is more alive than ever.

To begin, Carlos, who was Margarita Salas to you, and what impact do you think her work had on the world of science?

- Well, Margarita Salas was actually my PhD supervisor, in fact, I was the last student she supervised, as she passed away in 2019.

Margarita was incredibly passionate about science and about being in the lab. She always said she would work in the lab until the end of her days, and that's exactly what she did. Even after retiring, she continued coming to the lab and supervising PhD students almost right up until she passed.

As for her importance in science, especially in Spain, her impact was huge. She studied chemistry in Madrid, and during her studies, she had a pivotal moment at a family dinner, she was related by marriage to Severo Ochoa, who later won the Nobel Prize. At that dinner, she asked him what she needed to do to become a scientist like him. He told her to first do a PhD in Spain and then join his lab in the U.S. for postdoctoral research, and she followed that path exactly.

Right: Taken from "Científicas Casio", Margarita Salas poster.

She had a very productive research stay in the U.S., made key discoveries, and then returned to Spain with her husband Eladio, also a scientist she met during her studies. With funding from the U.S., they established what could be considered the first molecular biology lab in Spain, at a time when this field didn't yet exist in the country.

So, Margarita wasn't just a pioneer in biochemistry, she was also a foundational figure in the development of molecular biology in Spain. You could truly call her the "mother" of the field here.

Although we've already mentioned PCR in the introduction, could you explain in more detail how this technique works and why it has been so revolutionary for molecular biology?

- Well, as you said, we're all familiar with PCR, the polymerase chain reaction.

But it's important to clarify that Margarita Salas did not work directly on PCR itself. That technique was developed earlier, around 1985, by Mullis and others, and Mullis later won a Nobel Prize for it.

What Margarita did was develop a complementary technique, also involving a polymerase enzyme. Her first key paper come out a few years later, around 1989, with collaborators like Luis Blanco and Cristina Garmendia. While PCR focuses on detecting specific DNA sequences, Margarita's polymerase could amplify the entire genetic material present in a sample.

This is crucial for applications like forensic science or paternity testing, where the DNA in a tiny sample, like a drop of blood or a single hair, is far too little to analyze directly. A single human cell contains only a few picograms of DNA, but lab tests need thousands of times more to work.

Margarita's enzyme made it possible to multiply all the DNA in the sample enough to be studied.

So, while PCR helps detect known DNA sequences (for example, to check if a virus is present), Margarita's discovery allows scientists to amplify everything in a sample, unlocking powerful new possibilities in molecular biology and forensic science.

Besides PCR, what are some other discoveries by Margarita Salas, and what applications do they have in biology and medicine?

- Margarita Salas is best known for discovering the DNA polymerase from bacteriophage phi29, a tiny virus that infects bacteria. This enzyme became a highly successful tool for DNA amplification, widely used in forensics and medicine. While she didn't invent PCR, that was Mullis's work, her polymerase offers a powerful complementary method.

Her work shows how studying something very simple, like a small virus, can lead to big scientific breakthroughs. She also helped explain how cells read our genetic code and found a unique way some viruses copy their DNA, which is now used in gene therapy and vaccines like those for COVID-19. Margarita's story reminds us how basic scientific research is the foundation for many of the medical advances we rely on today, and how science is a team effort built by many people over time.

Right, up: Carlos D. Ordóñez, below: podcast episode cover.

"Margarita's story reminds us that basic scientific research is the foundation of many medical advances we rely on today, and that science is a team effort built by many over time."

How has Margarita Salas influenced the training of new scientists, and what do you think her legacy is in the field of molecular biology?

- One of Margarita Salas' greatest contributions to science in Spain was training new generations of researchers. Over 50 years, many scientists passed through her lab, with several now leading major research groups in Spain and internationally. Her dedication earned her awards, including recognition from Nature for her lifelong mentoring.

She helped establish molecular biology in Spain, and her influence shines through her students, like María Antonia Blasco, a telomere expert, and Cristina Garmendia, former Science Minister. Margarita's legacy lives on through these scientists, proving that science is a team effort where knowledge and innovation grow together.

MAGNESIUM

AN ALLY FOR YOUR LIVER HEALTH

Magnesium, an essential mineral often overlooked, plays a vital role in keeping our bodies running smoothly. From everyday issues like fatigue and muscle cramps to complex liver diseases affecting millions worldwide, magnesium is at the heart of our health.

Did you know that this humble mineral could be a game changer in treating serious liver conditions such as fatty liver disease, acetaminophen overdose, and alcohol-related liver damage? Recent research is shining new light on magnesium's potential to transform how we approach these diseases.

Before diving into the science, we want to honor Ana María Lajusticia, a true pioneer who, since 1980, dedicated her life to raising awareness about magnesium's importance. Her groundbreaking work reshaped how we understand nutrition and micronutrients. Though she recently passed away, her legacy continues to inspire today's research into magnesium and its impact on our wellbeing.

So, how exactly does magnesium influence liver disease? Can regulating its levels lead to better treatments? And why is this mineral so crucial for liver health?

To find out, we turn to Dr. **Irene González** and Dr. **Naroa Goikoetxea**, researchers at the Liver Disease Group at CIC bioGUNE, who will help us explore the fascinating role of magnesium in liver health and disease.

What role does magnesium play in maintaining liver health, and why is it so important?

- We're here to talk a bit about magnesium and what we've observed in the lab. What we know is that within the body, the liver is the primary organ responsible for regulating metabolism.

Maintaining the liver's balance is crucial for it to function properly. In this context, proper nutrition, providing the right macro and micronutrients, including magnesium, is essential. Among these nutrients, magnesium plays a key role in energy metabolism and enzymatic reactions.

One important element to highlight is the mitochondria, which generate energy within cells. As we age, we may develop a condition called hypomagnesemia, meaning our magnesium levels drop below what they should be. This deficiency can affect various aspects of the aging process.

We also know that as age increases, the risk of developing liver diseases rises. So, could hypomagnesemia be a contributing factor to these conditions? To prevent magnesium loss, maintaining a proper diet is very important. This could mean increasing the intake of magnesium-rich foods like seeds, nuts, spinach, and rice, or considering supplementation.

By doing this, we help maintain magnesium balance, which is vital for overall health. Given all this, our goal in the lab has been

Right: Taken from Pexels image bank.

to explore ways to monitor and control magnesium levels, especially in the liver, which is our main focus, to restore balance.

Regarding supplements, it's true that in older age, magnesium supplements might be the most recommended option to help counteract deficiencies.

Now that we have a general understanding of magnesium and the importance of nutrition, how exactly does magnesium regulation affect the liver, and what are the key mechanisms involved in maintaining its balance?

- Well, we know that magnesium doesn't simply pass through cell membranes on its own, it needs specific transporters that help maintain the balance we mentioned, both inside and outside the cell.

In simple terms, it's like magnesium can't open the door by itself, it needs the help of certain molecules, or transporters, to get in and out of the cell.

With that in mind, we decided to study the role of these transporters in the liver—both in healthy and diseased livers. What we found was that among all these transporters, one in particular, called CNNM4, showed significantly higher levels when the liver was damaged. That's why we chose to focus our research on CNNM4 in different liver diseases, exploring it as a potential new therapeutic target.

Earlier, we briefly mentioned some of these diseases in the introduction, but specifically, in which liver conditions have you observed magnesium dysregulation in your research?

- In our lab, we've studied several liver diseases and found that magnesium dysregulation plays a role in many of them. One clear example is paracetamol (acetaminophen) overdose, which is responsible for up to 46% of acute liver failure cases in the U.S. and 40–70% in Europe. The only available treatment, N-acetylcysteine (NAC), has a very short window of effectiveness, often too short for patients to benefit, leaving liver transplantation as the only alternative in severe cases. This makes it essential to explore new therapies. We analyzed both patient samples and animal models with paracetamol-induced liver damage and found not only altered magnesium levels, but also disruptions in a specific transporter called CNNM4.

We've also seen similar magnesium imbalances in other liver diseases, like fatty liver and alcohol-related liver damage, where poor nutrition and internal liver dysfunction both contribute. These findings are now being published in leading scientific journals, underscoring growing interest in magnesium as a potential therapeutic target.

We're continuing this research, expanding into new models and focusing on the broader role of magnesium across multiple liver diseases. So yes, perhaps María La Justicia, a well-known promoter of magnesium supplements in Spain, was onto something, magnesium really is important.

Right, up: Irene González & Naroa Goikoetxea, below: podcast episode cover.

"This treatment restored magnesium levels in liver cells, reduced damage, and improved survival in animals. We've patented it and are working to bring it into clinical use."

What treatments are being investigated to restore magnesium balance in the liver, and how could they be implemented in clinical medicine?

- We found that the magnesium transporter we studied is only highly expressed in the liver when it's damaged; under normal conditions, it's barely present. This transporter acts like a "door" that lets magnesium leak out of liver cells. So, supplementing magnesium alone isn't enough, if the door stays open, the magnesium escapes.

Since this transporter also plays key roles in other organs, we focused on developing a treatment that targets the liver specifically. We used an RNA therapy linked to GalNAc, a sugar molecule that directs the treatment to liver cells. This method is FDA-approved, safe, and easy to administer.

In our lab studies, this treatment restored liver cell magnesium levels, reduced damage, and improved survival in animal models. We've patented it for liver diseases and are now working to advance it toward clinical use.

CODIET

THE FUTURE OF PREVENTIVE NUTRITION

After the holidays, it's common to feel the effects of overindulgence; rich meals, tempting sweets, and routines thrown out of balance. While the occasional excess is part of celebration, it also reminds us of the important role that diet plays in our long-term health. Beyond temporary discomfort, poor eating habits are closely linked to serious chronic conditions like obesity, diabetes, and cardiovascular disease.

In recent years, scientific research has increasingly focused on how nutrition can be a powerful tool not just for recovery, but for prevention. One of the most ambitious efforts in this field is CoDiet, an international research project launched in 2023. Its goal is to better understand the connection between what we eat and how our bodies respond, using advanced technologies to develop more personalized and effective dietary strategies.

By combining nutritional science with artificial intelligence and real-time data collection, CoDiet is creating digital tools that can monitor individual dietary patterns and predict their impact on health. The project aims to move beyond general guidelines and toward tailored recommendations that reflect each person's unique metabolism, lifestyle, and health risks.

At the forefront of this work are Dr. **Óscar Millet**, principal investigator of the Precision Medicine and Metabolism group, and Dr. **Nieves Embade**, research assistant in the same group, both based at CIC bioGUNE. Their research is helping to shape a future where diet becomes a truly personalized and preventive medicine – accessible, effective, and guided by science.

To understand how this innovative project is changing the way we think about nutrition and health, let's start with the basics. What exactly is CoDiet, and what is its main goal?

- Well, as you mentioned, and your summary was spot on, CoDiet is an international project funded by the European Union, with the participation of over 10 countries, including the UK. The main goal of this project is to explore the connection between diet and a set of chronic diseases that have become a growing epidemic in Western societies: obesity, diabetes, and hypertension.

The World Health Organization recently reported that 41 million people die each year from conditions related to these issues. That accounts for about 75% of all annual deaths. So, it's clearly a serious global health challenge. While many scientific studies have tackled these problems, with some very promising results, there are still knowledge gaps. We don't yet fully understand the exact mechanisms that lead to these diseases, or how they evolve into more serious complications like cardiovascular disease.

That's where CoDiet steps in. The project aims to fill these gaps by analyzing all the data we gather and using artificial

Right: Taken from Pexels image bank.

intelligence to generate personalized dietary advice. The idea is to help people adjust their nutrition in ways that could reduce the risk of developing these conditions.

It's also important to mention that many past studies haven't adequately represented certain population groups—especially those with fewer economic resources. These communities often face greater difficulty accessing healthy food, and as a result, conditions like obesity and diabetes are disproportionately prevalent.

So in essence, CoDiet is a large-scale, collaborative effort that seeks to improve people's lives through better, more personalized nutrition based on solid scientific evidence.

How does CoDiet use technology to personalize our diet?

- Well, CoDiet uses technology in several ways. Here at CIC bioGUNE, our main contribution focuses on metabolomic profiling, that is, analyzing biological samples to detect and quantify metabolites using nuclear magnetic resonance (NMR). This technique is extremely robust and reproducible, which makes it ideal for identifying and characterizing these small molecules.

For those less familiar with the term, metabolites are tiny molecules found in our body fluids. They're essential components of cells and play key roles in keeping them functioning properly. Some of these metabolites are directly influenced by what we eat.

So one of our goals is to link specific dietary habits to changes in metabolite levels and, in turn, relate those changes to health outcomes. This creates a sort of triangle: diet, metabolites, and health. That's one of the key ways CoDiet is working to personalize nutrition.

Beyond metabolomics, other research teams involved in the project are also applying various "omics" technologies, like transcriptomics and genomics, to study cells at different levels. Eventually, all of this data will be integrated to give a comprehensive picture. But here at CIC bioGUNE, our main focus is definitely on metabolomics.

"By analyzing genetic and metabolic data, CoDiet hopes to predict individual responses and move toward tailored dietary guidance. Beyond the science, the human side is inspiring."

Right, up: Óscar Millet and Nieves Embade, below: podcast episode cover.

That's already giving us a little preview of the next question, isn't it? Which is, what role does CIC bioGUNE play in CoDiet, and how does it contribute to the project?

- Since the lab started, Óscar has focused on metabolomics using nuclear magnetic resonance to identify metabolites involved in these processes, giving us broad expertise. Experimentally, this is our main contribution.

We also conducted a pilot study with about 20 participants, mostly with obesity or overweight and some cardiovascular risk factors like high triglycerides. For 8 weeks, we monitored their diet using advanced devices, like cameras that accurately capture food portions, to get precise dietary data, which is often hard to collect.

Along with physical measurements, samples were analyzed by five European labs, including genomic studies. Now, all this data is being processed using artificial intelligence, which plays a key role in handling and analyzing such large, complex datasets.

How do you think personalized nutrition will evolve in the future, and what insights are expected from the CoDiet project?

- CoDiet aims to understand how our dietary habits trigger molecular changes in the body. One focus is identifying new links between metabolites and diet to better grasp nutrition's role in diseases like obesity, fatty liver, and diabetes.

It also explores why people respond differently to the same foods, the basis of personalized nutrition. By analyzing genetic and metabolic data, CoDiet hopes to predict individual responses and move toward tailored dietary advice.

And beyond the science, the human side has been inspiring. Volunteers shared their habits and used smart cameras to track meals, their involvement gives real meaning to the project.

CIC bioGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

EXCELENCIA SEVERO OCHOA

EUSKO JAURLARITZA GOBIERNO VASCO

Established in 2004 under the auspices of the Basque Government, CIC bioGUNE is dedicated to advancing biomedical science. Its interdisciplinary team of over two hundred scientists and technicians delves into the molecular foundations and mechanisms of diseases, aiming to innovate in diagnostic methods and foster the advancement of innovative therapies.

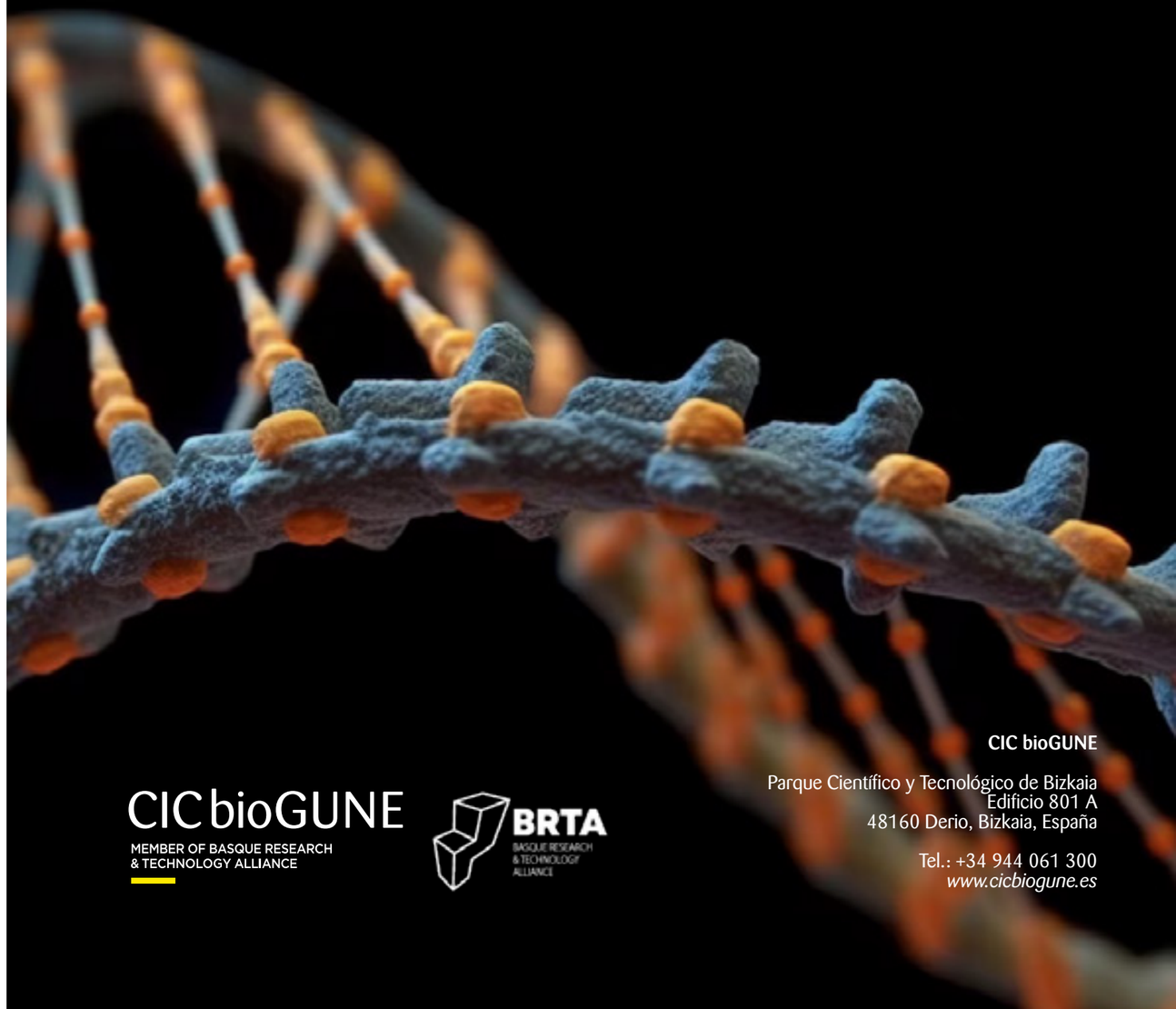
Recognized as a Severo Ochoa Center of Excellence, CIC bioGUNE leads cutting-edge research at the intersection of Biology, Chemistry, and Mathematics, focusing on Cancer, Rare Diseases, Infectious Diseases, and Metabolic Disorders. Our infrastructure includes advanced technological platforms that support scientific discovery and collaboration, positioning us among Europe's foremost research institutes.

We are committed to bridging the gap between complex scientific research and public understanding through diverse outreach activities. By translating our research into accessible language and engaging the community in scientific advancements, we emphasize the importance of investing in research for societal progress and well-being. These efforts not only strengthen our connection with stakeholders but also promote broader appreciation and engagement with science for the benefit of society.

Transcriptions, editing and layout:

These podcast episodes have been transcribed, translated, edited, and formatted for this magazine by **Jana Sendra Viscarro**.

"Cutting-edge science advancing at the frontier between Chemistry, Structural, Molecular and Cellular Biology, aiming to develop a more Precise Medicine for the future"



CIC bioGUNE
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

BRTA
BASQUE RESEARCH & TECHNOLOGY ALLIANCE

CIC bioGUNE

Parque Científico y Tecnológico de Bizkaia
Edificio 801 A
48160 Derio, Bizkaia, España

Tel.: +34 944 061 300
www.cicbiogune.es