NEWSLETTER

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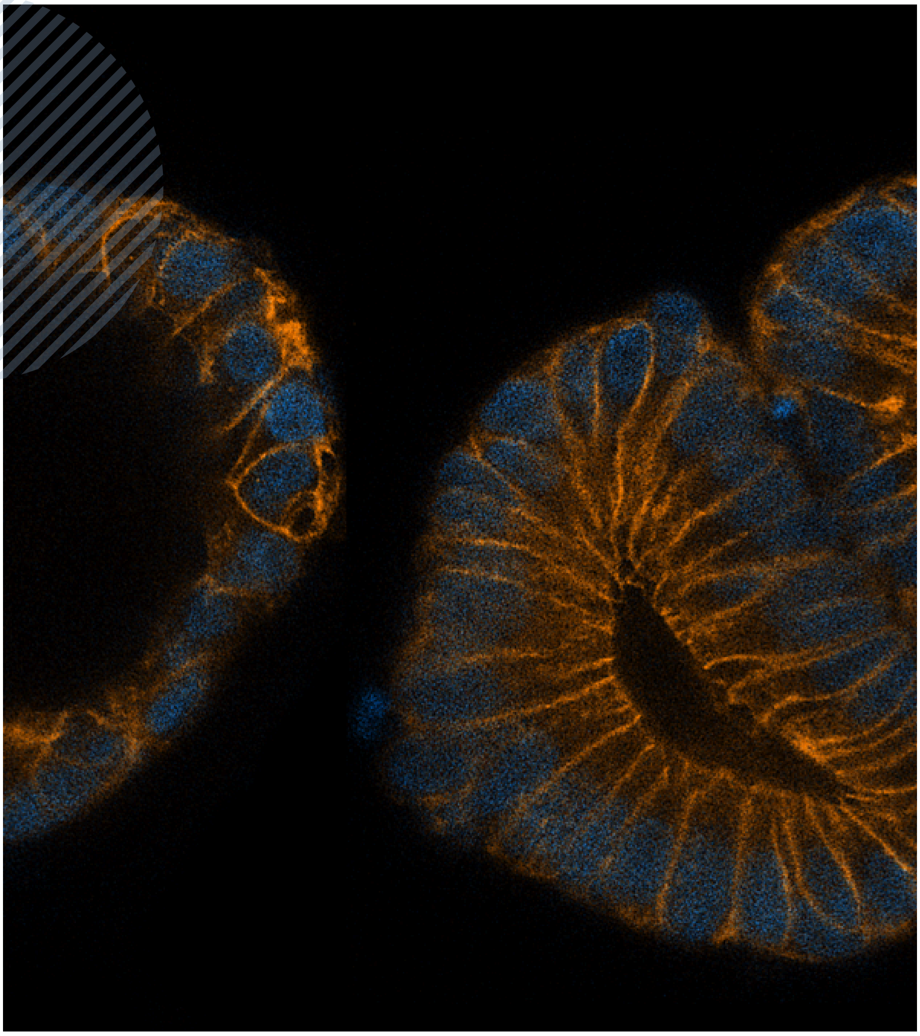

Confocal microscopy image of human intestinal organoids from a healthy individual (left) and an individual with Cystic Fibrosis (right), stained for β-catenin (orange) and nuclei (Hoechst, blue).

Inês Pankonien and Hugo Botelho
FCUL-BioISI Microscopy Facility

IN THIS EDITION

Editorial

10th Edition

In this Edition:

In this issue, we feature an interview with Margarida Amaral, from the Faculty of Sciences of the University of Lisboa. She reflects on her academic journey, scientific achievements, and the challenges she has faced along the way. She also discusses her recognition as an EMBO member and highlights the importance of SPB and FEBS in supporting the scientific community.

In the News and Views section, Teresa Neto, from the University of Minho, offers her insights into soil functionality and the challenges posed by the urban crisis.

This newsletter also highlights upcoming events, including the XXIII National Congress of Biochemistry, the Biophysics Festival 2026, the XVII Plant Cell Wall Meeting, the Portuguese Ageing Research Group Web Seminars, and the 50th FEBS congress.

We send our warmest Easter wishes to all members of the SPB community!

The SPB Directive Committee

Interview

For this edition's Newsletter, we talked to Margarida Amaral, Full Professor at the Faculty of Sciences of the University of Lisboa, group leader at BioISI, current delegate of Portugal at the European Molecular Biology Laboratory and the European Molecular Biology Conference and SPB member since 1981.

We'll begin by asking a brief summary of your career and what motivated/attracted you at each stage.

As a child, I gained high interest in Math and Science, supported but not pressured by both my engineer parents.

From an early age, I had a clear preference for exact sciences over humanities, Portuguese language and literature were my Achilles heel. Nevertheless, I did get an award in History in my 7th grade for being the best in the school that year!...

I remember my mother being called to school to meet my 5th grade Math teacher, which alarmed me, as I was well behaved and such meetings usually meant trouble. Instead, the teacher praised a comment I had made about representing infinite numbers as an infinite line, noting that this was an unusually insightful association for a 10-year-old and encouraging my parents to nurture a future in science. My mother, however, played it down, mentioning it to friends more as an odd reaction from the teacher than as an achievement. To her, I was simply doing what was expected: paying attention and getting good marks was my duty.

In the final two years of high school, when we had to choose between science and humanities, science subjects were the obvious choice for me, alongside foreign languages and art.

Biology, however, was out of the question, as the practical classes involved dissecting animals, which I could not face. During these years, Math remained a favourite, particularly algebra, trigonometry, logic and proofs, and I often achieved top marks.

It was also then that an exceptional Physics & Chemistry teacher shaped my decision to pursue (Bio)chemistry at University, making the subject feel so logical and elegant that problem-solving became more enjoyable than any leisure activity.

When she invited a small group of us to attend informal Organic Chemistry classes over the Summer, we embraced the opportunity with great enthusiasm.

What inspired you to work in Biochemistry, and more particularly in Molecular Biology and Molecular Mechanisms of Disease?

Above all, I wanted to study Biochemistry so as to apply the Chemistry I loved to unravel the mechanisms of living organisms, in particular to understand human disease. At the time, however, there was no Biochemistry degree in Portugal, which further motivated me to study abroad. Biology was not an option, for the same reasons as in secondary school, and Medicine, though academically within reach, required Biology as an elective, which I had not taken. I therefore chose Chemistry, then a five-year degree, attracted by its strong focus on exact sciences and the option to specialise in Organic Chemistry/Biochemistry in the final two years. This suited me perfectly, as I saw the first three years as a natural preparation for Biochemistry.

What discovery surprised you the most?

The most surprising discovery from my research was the data we obtained regarding the mutant CFTR protein, which I published in 2005 [PMID: 15923638] with Carlos Farinha (my first PhD student, now Associate Professor at FCUL).

At the time, it was generally believed that proteins going through the secretory pathway (SP) followed a single, standard "quality control" path in the cell's protein factory for SP proteins (i.e., the endoplasmic reticulum or ER) involving a specific molecular chaperone (or "helper") called calnexin.

However, our data showed something unexpected: the most frequent mutant protein responsible for Cystic Fibrosis (p.Phe508del-CFTR) is actually identified as faulty and discarded earlier than the normal version of CFTR protein.

Moreover, this finding was significant because it led us to propose a new model for the ER cellular quality control based on several distinct checkpoints. We discovered that the cell uses a series of "inspections" to assess the "folding status" of SP proteins rather than just one. While proteins which fold properly fast move on to later stages of the SP, some others, folding deficient, like the above mutant protein is "trapped" and degraded at the very first "gate", long before it even encounters calnexin.

What was (or is) the biggest challenge in doing science/in your field?

The most significant challenges I faced in pursuing science were primarily institutional. Although I held a position during my PhD as a Teaching Assistant (later continuing as an Assistant Professor), there were no research laboratories or adequate infrastructure at my university. To conduct research, I volunteered as a visiting researcher at the Instituto Nacional de Saúde Dr. Ricardo Jorge (INSA), where I had to establish a laboratory from scratch, without any initial seeding funds.

At that time, teaching was regarded as the principal duty of a university Professor, and research was often seen as secondary activity, almost a "hobby". I was advised to "take it easy" in obtaining funding for research (namely from international sources), so as not to neglect teaching, which made sustaining a serious research program particularly challenging.

At the international level, the major challenge was that Portuguese scientists did not yet enjoy a strong reputation for high-level scientific outputs. As a result, one had to work considerably harder to gain visibility and credibility in international forums.

Establishing oneself required producing work of unmistakable quality and consistency in order to overcome preconceived expectations. However, I must also note that the international scientific community ultimately functions as a merit-based environment. Thus, once a solid scientific record was established, I was respected and treated as a peer within the international community.

What was it like to be recognized as a member of EMBO?

Being recognized as a member of EMBO was both deeply meaningful and symbolically powerful. Coming from an institutional environment with limited infrastructure, where research was not initially regarded as a central academic mission, this recognition represented validation not only of my scientific work but also of the perseverance required to sustain it.

It was particularly significant given the early international prejudices faced by Portuguese scientists.

The distinction signalled that the quality of the work had transcended institutional and geographic constraints. Publications in highly regarded journals such as Cell, Proceedings of the National Academy of Sciences (PNAS), and Nature Genetics were instrumental in building the scientific credibility that made this achievement possible

Above all, EMBO membership conveyed peer recognition at the highest European level, affirming that sustained excellence, even under challenging conditions, can ultimately be acknowledged and respected.

What do you believe is the importance of SPB and FEBS in the current context of science in Portugal and the world?

In the current scientific landscape, SPB and FEBS play crucial strategic roles, both nationally and internationally.

For Portugal, SPB provides an essential platform for scientific cohesion, visibility, and mentoring, particularly for younger researchers working in environments that may still face structural limitations. It helps consolidate standards of excellence, promote collaboration, and strengthen the international integration of Portuguese science.

FEBS, and I also add EMBO, at the European level foster mobility, networking, advanced training, and policy dialogue, reinforcing scientific quality across borders. Importantly, these organizations offer researchers from smaller or historically less visible scientific systems equitable access to competitive arenas.

Together, SPB and FEBS (and EMBO) contribute to embedding Portuguese research within the global scientific community, ensuring that merit, collaboration, and shared standards (rather than geography) define scientific recognition and impact.

News & Views

The real urban crisis lies below the soil surface

Teresa Lino Neto, Departamento de Biologia, Centro de Biologia Molecular e Ambiental, Escola de Ciências, Universidade do Minho, Braga, Portugal

Two narratives dominate the debate on the challenges of the 21st century: population growth and accelerated urbanization. The first is framed as a demographic issue; the second as a territorial one.

Both are real, yet they are rarely considered together—and almost never in relation to soil, where a critical share of ecological stability is determined. According to UN projections, the global population is expected to peak at around 10.3 billion in the mid-2080s, stabilizing slightly at approximately 10.2 billion by the end of the century (*UN World Population Prospects 2024*).

However, it is not merely the absolute number of inhabitants that creates structural challenges, but rather their increasing concentration in urban areas. Since 1950, the global human population has doubled overall and quintupled in urban contexts (*UN World Urbanization Prospects 2025*).

At the same time, urbanized land has expanded at an even faster rate—a phenomenon known as urban sprawl. Suburbs, industrial zones, logistics parks, and dense networks of infrastructure—roads, airports, energy grids, and sanitation systems—transform living soils into artificial surfaces. The city does not grow only "upward"; it also grows "outward" and "downward," converting soil into structural support while discarding it as a functional ecosystem.

Sealing - when the soil ceases to function

Soil sealing consists of covering land with impermeable materials such as concrete, asphalt, and continuous pavements. This process leads to impermeabilization and the loss of infiltration capacity. Consequently, soil porosity and gaseous diffusion are reduced, and water and oxygen fluxes within the soil profile are interrupted. Sealing also eliminates the natural habitat of countless species, promoting ecological fragmentation and the gradual collapse of microbial diversity and soil fauna.

The concept of "biodiversity loss" is often used generically. However, in the context of soil, this loss assumes an extremely functional dimension: the interruption of biogeochemical cycles and the enzymatic machinery that sustains fertility, carbon storage, and water quality. Soils host more than 25% of global biodiversity and underpin the production of 95-99% of the food consumed by nearly 8 billion people (European Commission, 2020).

Despite their ecological and socioeconomic importance, approximately 70% of soils in the European Union are estimated to be in poor condition due to processes such as erosion, loss of organic carbon, sealing, and contamination (European Environment Agency, 2023).

In functional soil, organic matter is continuously processed by microbial communities, enabling decomposition, humification, and carbon stabilization in recalcitrant forms. This biogeochemical dynamic is crucial for maintaining soil quality, sequestering carbon, and contributing to climate regulation. With sealing, the availability of organic residues declines, microbial biomass decreases, and consequently the formation of stable aggregates is reduced. Soil structure degrades, and its capacity to act as a carbon reservoir diminishes. Moreover, microbial respiration, an indicator of active metabolism and substrate processing, becomes residual. This is due not to reduced efficiency but because of habitat collapse, substrate limitation, and impaired gas diffusion.

Within the nitrogen cycle, the effects are equally significant. Processes such as biological nitrogen fixation, nitrification, denitrification, and mineralization depend on metabolically active microbial communities. They also require suitable physicochemical conditions, including oxygen gradients, moisture levels, and redox potential that allow aerobic and anaerobic pathways to coexist. Impermeabilization eliminates this environmental heterogeneity, disrupting the gradients that are essential for maintaining nitrogen cycle reactions.

The phosphorus and sulfur cycles are also affected, as they depend on the mineralization of organic phosphorus, biological phosphate solubilization, and redox transformations of sulfur compounds mediated by microorganisms and enzymes.

From a biochemical perspective, sealing soil is equivalent to shutting down a complex metabolic system, compromising potential fertility and reducing the soil's function in greenhouse gas regulation. The soil ceases to function as an open, metabolically active system and instead behaves as an inert and functionally impoverished substrate.

Moreover, sealing affects not only biological activity but also the physicochemical matrix that sustains biochemical processes. Microbial production of exopolysaccharides and humic substances plays a central role in soil particle aggregation and in maintaining structural porosity. Without significant biological activity, structural stability declines, macroporosity is reduced, microbial communities become simplified, and functional redundancy and ecological resilience decrease.

Among the most neglected ecosystem services provided by soil is its role as a biofilter.

Under natural conditions, soil acts as an active biochemical barrier: it retains nutrients, adsorbs potentially toxic compounds, promotes microbial degradation of contaminants, and transforms fluxes before they reach water bodies.

By preventing infiltration, sealing converts urban hydrology into a regime dominated by surface runoff. Water is no longer purified and instead transports contaminants directly into aquatic systems. In other words, part of the water quality problem stems from the loss of soil functionality.

Rethinking urban sustainability from the ground down

Is unsealing sufficient to restore soil functionality? Scientific evidence demonstrates that after years or decades of impermeabilization, microbial diversity and soil functionality do not recover spontaneously.

Reconstituting edaphic communities often requires reference soil transplants or biological inoculation, which are technically demanding, costly, and yield uncertain outcomes. Soil sealing is not simply a matter of inappropriate land use; it represents profound ecological deactivation with long-term functional consequences. For this reason, the European Environment Agency argues that urban planning must protect, conserve, and restore functional soils while ensuring ecological continuity within the soil system.

Preserving soil biological integrity means preventing urban infrastructure from completely interrupting fundamental biochemical flows—of water, gases, organic matter, and microbial dispersal. A truly sustainable city in the 21st century cannot simply be "greener" at the surface; it must be structurally less disruptive to the soil beneath it.

The European "*no net land take by 2050*" strategy reinforces the need for monitoring and restoration, although implementation depends on Member States. Within this framework, France and Germany stand out as references for introducing clear quantitative targets to reduce land artificialization.

France established the objective of "Zéro Artificialisation Nette" (ZAN) by 2050, requiring that any new soil artificialization, like urbanization, construction, or sealing, be counterbalanced by equivalent renaturalization. It also set a mid-term target of reducing the consumption of natural, agricultural, and forest land by 50% by 2031.

Germany, in turn, defined quantitative goals to reduce daily land consumption to below 30 hectares by 2030, explicitly recognizing land take as a core sustainability indicator. In most other European countries, sealing is addressed indirectly and fragmentarily through urban planning instruments, stormwater management, or agricultural protection, but rarely as a central ecological priority with quantified national targets. This difference reveals the degree of political centrality attributed to soil's ecological functions.

The future is decided below the surface

Continuing to expand territory as if soil were a neutral and inert resource ignores a fundamental reality: soil is a living, metabolically active, and irreplaceable system.

The urban future must be more compact, regenerative, and ecologically integrated, incorporating multidisciplinary approaches into spatial planning.

Concepts such as the '*sponge city*', developed by architect Kongjian Yu, demonstrate that in urban design soil can be recognized as natural infrastructure. As such, it can recover infiltration, retention, and hydrological regulation functions, reducing flood risk and strengthening climate resilience.

Soil thus ceases to be understood merely as a physical support for construction and becomes integrated as an active component of climate and hydrological adaptation.

This understanding is reinforced by the new European legislative framework, notably the Nature Restoration Law, which establishes binding ecological restoration targets and requires concrete implementation in urban contexts.

The *EU Soil Strategy for 2030* and the *EU Mission "A Soil Deal for Europe"* further position soil as a strategic asset for food security, climate mitigation, and long-term ecological stability.

If the 21st century aspires to be the century of sustainability, it must recognize that environmental stability is not determined solely in the visible landscape, but in the functional integrity of what remains unseen.

This issue becomes even more profound when framed within the One Health concept, which acknowledges the interdependence between human health, biodiversity, and ecosystems.

Fertile and biologically active soils are not merely a factor of agricultural productivity; they underpin the production of nutritionally rich food, an essential condition for healthy human populations.

When soils degrade, it is not only agronomic fertility that is lost; food systems are weakened, diets impoverished, social vulnerabilities increased, and environmental risks intensified.

A truly advanced city, therefore, is not the one that occupies more territory, but the one that understands that human health begins with the health of the soil that sustains it.

Taken together, this leads to a simple conclusion: the future will not be decided in skylines or infrastructure, but in the living ground that sustains them.

Fig. 1. Sustainable growth begins with preserving the soil and the biochemical processes that sustain life. Image generated with the support of ChatGPT (OpenAI).

Calendar & Events

DATE	EVENT	PLACE	LINK
Monthly Online Seminars	**PAGE 2026: Web Seminars of the Portuguese Ageing Research Group**	Monthly Online Seminars	LINK
27 – 29/05	**KSBMB International Conference 2026 - From Molecules to Megabytes**	BEXCO, Busan South Korea	LINK
30/05 – 04/06	**EUROMIT 2026**	Angers Convention Centre, France	LINK
11 – 12/06	**6th Meeting of Young Biophysicists - Biophysics Festival 2026**	Faculty of Sciences and Technology of the University of Coimbra, Coimbra, Portugal	LINK
15 – 19/06	**XVII Plant Cell Wall Meeting**	Porto Portugal	LINK
04 - 08/07	**The 50th FEBS Congress**	Maastricht The Netherlands	LINK
07 – 09/07	**EuroCurvoBioNet Training School 2026, Curvature Across Scales**	Delft University of Technology, Delft The Netherlands	LINK
31/08 – 04/09	**25th European Conference on Computational Biology**	Geneva, Switzerland	LINK

Calendar & Events

DATE	EVENT	PLACE	LINK
21 – 27/09	**VI International Symposium on Fungal Stress – ISFUS**	São José dos Campos, SP, Brazil	LINK
10 – 16/10	**Champalimaud Research Symposium 2026 - Neural and Immune Codes in Cancer**	Champalimaud Centre for the Unknown, Lisbon, Portugal	LINK
22 – 23/10	**XXIII National Congress of Biochemistry**	University of Beira Interior, Covilhã, Portugal	LINK