NEWSLETTER

SOCIEDADE PORTUGUESA DE BIOQUÍMICA

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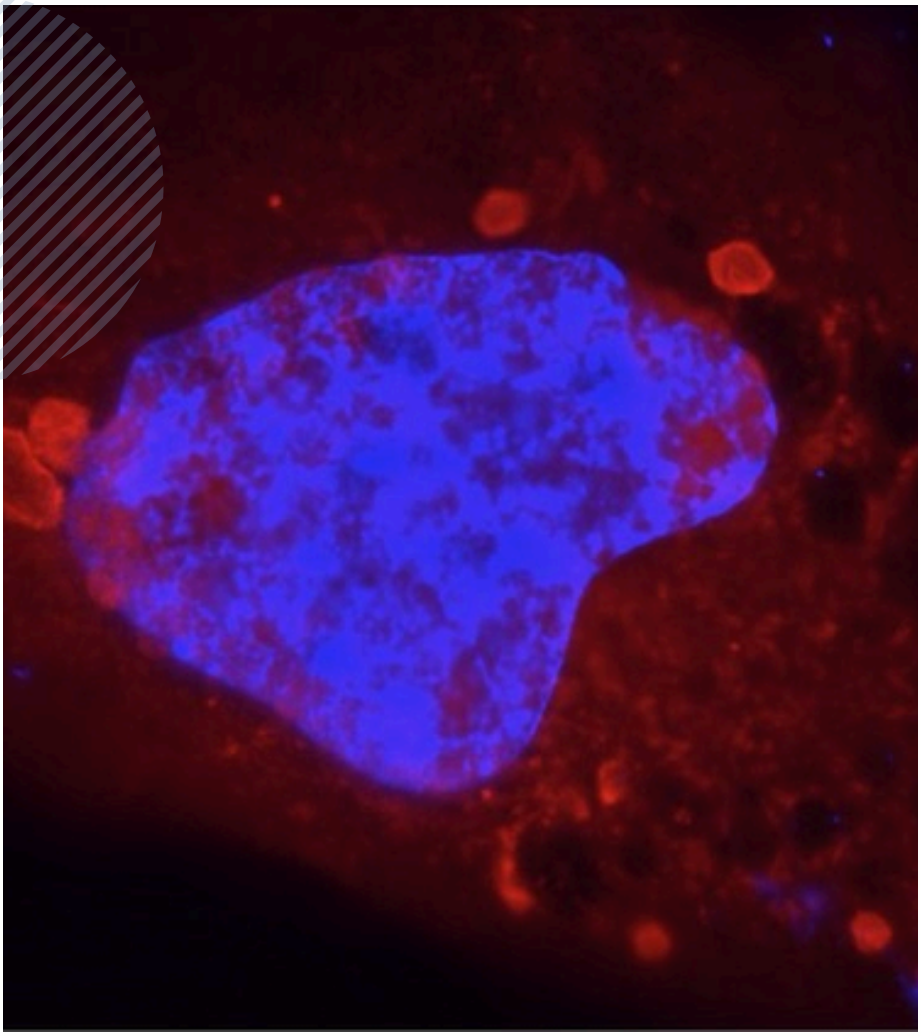
Edition 9



Human cells displaying alfa-synuclein inclusions.

Tiago F. Outeiro
University Medical Center Göttingen
Germany

IN THIS EDITION

Editorial

9th Edition

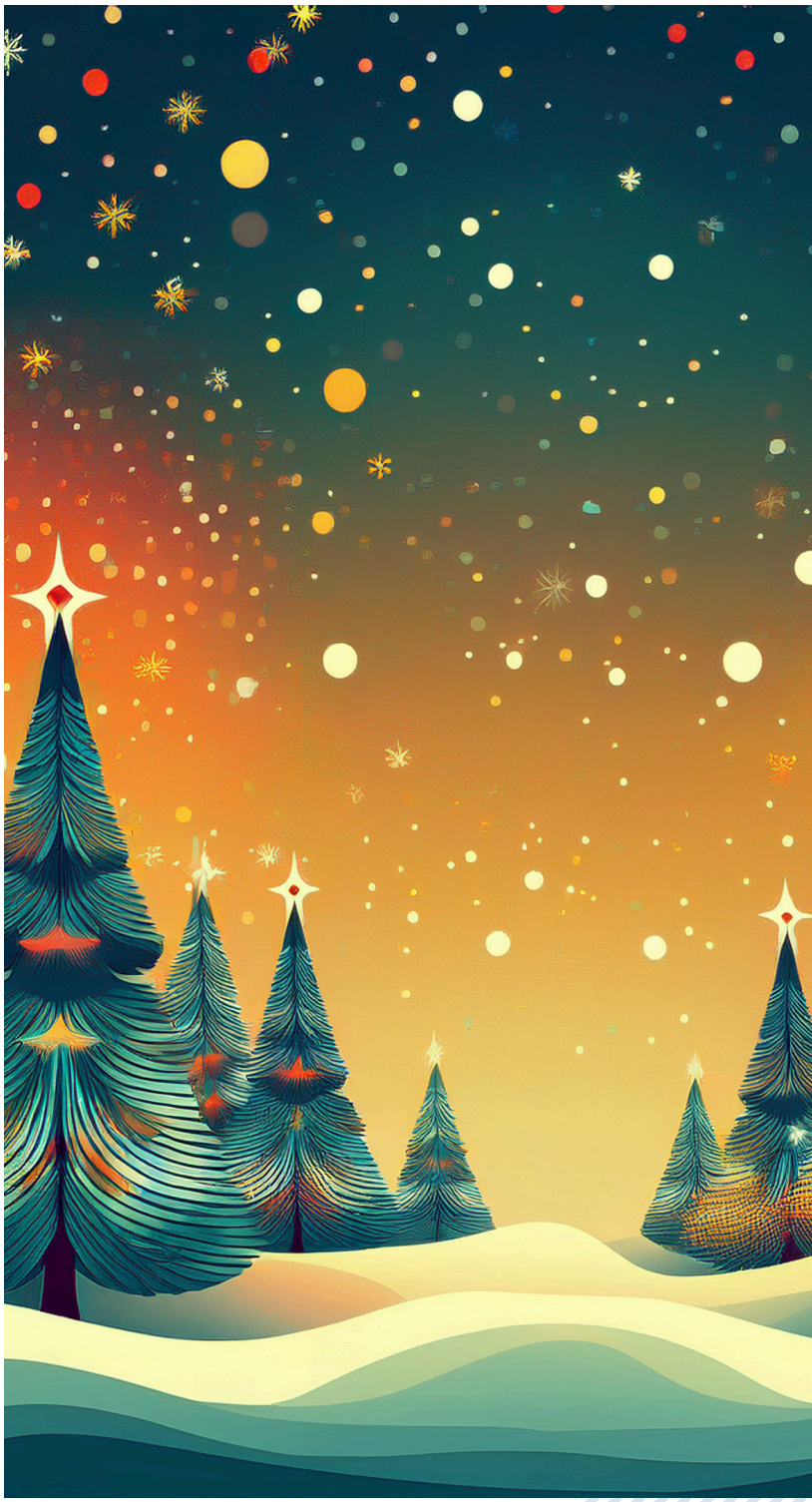
In this Edition:

This edition of the SPB Newsletter showcases activities organized by the thematic group Redox Biology and Oxidative Stress, and by the SPB junior section.

In this issue, Manuel António Coimbra from the University of Aveiro shares reflections on his research interests, involvement in biochemistry education, the challenges facing bioscience research and education, and his contributions to scientific societies. We also feature Tiago Outeiro, from the University Medical Center Göttingen, Germany, and University of Algarve, who offers a biochemist´s perspective on neurodegeneration.

The newsletter also highlights upcoming events, including the FEBS Education and Training Conference, the YSF2026 and the 50th FEBS congress.

We extend our warmest wishes to all SPB members for joyful holidays and an inspiring, successful and prosperous New Year of 2026! May the coming year bring exciting discoveries, fruitful collaborations, and continued growth for our vibrant community.



The SPB Directive Committee

Interview

For this edition's Newsletter, we talked with Manuel António Coimbra, Full Professor of the University of Aveiro.

In brief, can you tell us what your research interests are and what are the most significant achievements in your scientific career?

My research interests are focused on carbohydrate biochemistry, mainly polysaccharides, aiming to relate their chemical structure with their function in biological systems, and the properties they can provide when applied to develop materials and/or food ingredients.

Because, fortunately, I was never alone when making science, my achievements were those of the groups I have been collaborating with.

I can highlight the contribution to the detailed structural characteristics of polysaccharides when submitted to high temperature and low water activity, conditions that occur when coffee beans are roasted, enabling to explain the properties of coffee brews, including those of espresso coffee, or the contribution to the detailed structural characteristics of polysaccharides with immunostimulatory activity, as those of plant cell walls.

These two sets of works provided us with many scientific citations of our papers. However, I would like also to highlight as a significant achievement our contribution to the certification of *Ovos Moles de Aveiro* with the label of Protected Geographical Indication (PGI). Although a scientific paper has never been published on this subject, the recognition of this activity by the community is a mark of a scientific career.

How has your involvement in biochemistry education shaped your professional journey?

After finishing my graduation in Biochemistry at the University of Porto, in 1985, I started my professional career at the University of Aveiro, at the Department of Chemistry. At that time, the University was looking for Biochemists to support the teaching of Food Chemistry integrated in the graduation of Chemistry.

Focused on that opportunity, I started studying the immobilization of food enzymes and, later, the relationships of the structure of polysaccharides with their functionality. This was a big shift in my interests, which started with Clinical Biochemistry, studying the protein responsible for erythrocyte spherocytosis at the University of Porto with Prof. Pedro Moradas Ferreira.

My interdisciplinary biochemical education was a relevant support for me when I started teaching laboratory practical classes at a Department of Chemistry and later on when I moved to teach metabolism and enzymology. My research, as well as the way I approach the students in my classes, has been shaped by this holistic view of how Biochemistry can explain how nature works by integrating Chemistry, Biochemistry, Biology, Nutrition, and Health.

What do you see as the main challenges facing bioscience research and education in the coming years?

When I was a student (we are always students!), our professors provided us with the scientific information that, at that time, was not easily available in specialized books and papers. However, nowadays, students have all the required information and much more with a few clicks. This change of paradigm is a main challenge to be faced by teachers and students. Nowadays, the tricky point is to educate for the identification of the appropriate information enabling the formulation of the relevant scientific hypotheses, seeking the answers necessary to advance bioscience research knowledge. Having that awareness is a high contribution for our success.

Could you share your contributions to scientific societies, particularly to the Sociedade Portuguesa de Bioquímica (SPB)?

My contribution to scientific societies has been more focused on the Portuguese Society of Chemistry, where I was the President of the Carbohydrate Group, allowing us to organize in Aveiro the first Iberian Carbohydrate Meeting, joining in 1999 scientists for all over the world, among other activities.

I also participated as treasurer during several years at the Portuguese Society of Biotechnology. In collaboration with the Portuguese Society of Microbiology, we also were able to organize in Aveiro the MicroBiotec13 with great success. Considering the SPB, I have been collaborating with the students of Biochemistry as speaker in some of their annual meetings, as well as in the organization of the Biochemistry Day at the University of Aveiro.

The Biochemistry Day is an occasion for promotion of several contests for students, including a Biochemistry Poster Session contest, A Metabolic Map contest, a Pitch contest, involving all community around Biochemistry and its applications. It is also an occasion to have scientific talks of a thematic subject and to listen to the experiences of former students about the relevance of their formation in Biochemistry to the real word materialized in their jobs.

What opportunities within SPB would you recommend to scientists at yours or earlier career stages?

SPB organizes regularly scientific events that are platforms for students and scientist to be aware of the main achievement in the field and who are the active players.

I am also witnessing that SPB is very active in supporting students' organizations in Portugal and connecting Portugal with the world, namely with FEBS. Through SPB, Portugal has also been a player in Educational Biochemistry, paving the way for a better teaching and motivation of students for Biochemistry in Portugal.

News & Views

A biochemist's perspective of neurodegeneration: understanding the causes in order to develop future therapies

Tiago Fleming Outeiro, University Medical Center Göttingen, Germany, and Faculdade de Medicina e Ciências Biomédicas, Universidade do Algarve, Portugal

Protein Structure and Function in Biology and Pathology

Biochemistry, founded on understanding the molecular mechanisms governing life, is evolving rapidly with the advent of omics technologies and imaging techniques that allow us to assess and observe biological processes across scales — from atomic arrangements in proteins to intercellular and inter-organ communication within organisms.

The genomic revolution is enabling the identification of a growing number of genes, both coding and non-coding.

While converting gene sequences into protein information is straightforward, understanding the relationship between protein structure and function remains a formidable challenge, despite recent advances in AI-based 3D protein structure prediction (1). We all know, from basic biochemical principles, that protein structure is intricately linked to function. As a corollary, structural alterations often impair the biological function of proteins. In this context, extreme cases of misfolding and aggregation trigger cellular responses impacting physiology, sometimes adaptive but often toxic.

Over the years, my research has focused on investigating molecular mechanisms associated with protein misfolding and aggregation, especially in pathologies characterized by the accumulation of aggregated proteins, such as neurodegenerative diseases, diabetes, and cancer. Recent studies reveal that aggregation is more complex than previously thought and can serve adaptative cellular roles as part of normal biology, challenging the view of aggregation solely as a pathological event.

Proteostasis: Folding and Unfolding in the Crowded Cellular Environment

Protein aggregation has been extensively studied *in vitro*, showing a characteristic kinetic curve with lag, exponential growth, and plateau phases (2). However, how folding and unfolding occur in the dense cellular environment crowded with a multitude of biomolecules is less understood. Cells maintain protein homeostasis (proteostasis) via intricate networks that include molecular chaperones and degradation pathways, like the ubiquitin-proteasome and autophagy pathways (3-4). These networks respond dynamically to environmental challenges to prevent proteotoxicity.

Prions: One Genome, 'Two' Phenotypes

My interest in protein unfolding and aggregation began amid the 1990s concerns over the transmission of bovine spongiform encephalopathy (BSE) to humans.

Landmark studies by Prusiner, Lindquist, and others showed that certain proteins like the prion protein (PrP) in mammals, or the yeast Sup35 protein, could exist in distinct conformations—soluble or aggregated—yielding different phenotypes.

While in the case of PrP, aggregation is associated with devastating diseases (5), the aggregation of the yeast protein Sup35 may result in adaptive advantages (6). Today, protein aggregation is understood as a complex process, involving also a liquid-liquid phase separation phenomenon that, with disease progression, can become a solid, irreversible amyloid, causing loss of function and toxic gain-of-function, contributing to neurodegeneration, cancer, diabetes, and even infectious diseases.

Protein Aggregation: A Common Feature of Neurodegenerative Diseases

Under stress, mutations, post-translational modifications (PTMs), or aging, proteostasis can fail, leading to misfolding and aggregation of proteins. During the process of protein aggregation, it is thought that some of the species formed, such as those referred to as oligomeric species, might be cytotoxic (Figure 1).

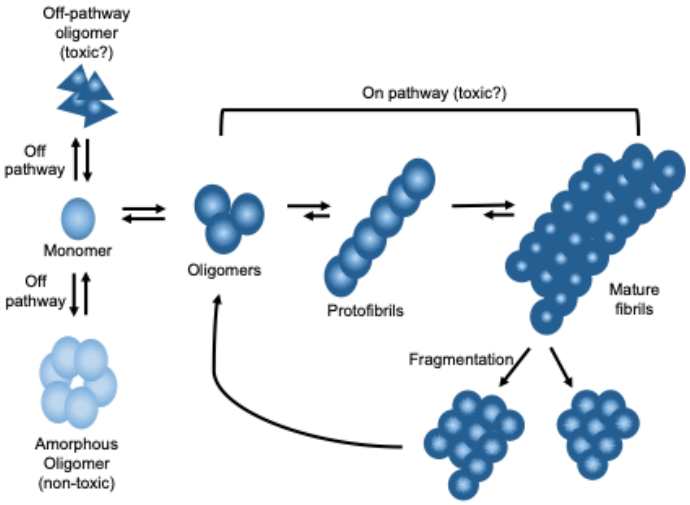


Figure 1. Schematic representation of the process of protein aggregation and toxicity. Proteins, in a monomeric state, can follow different pathways. In one of them, they can form oligomers that continue the assembly process, giving rise to protofibrils and then amyloid fibrils, which are the most stable form. These fibrils can undergo fragmentation, acting as 'seeds' that accelerate the aggregation process. In this process, some species may be cytotoxic.

This process is shared by major neurodegenerative diseases such as Alzheimer's disease (AD), Parkinson's disease (PD), and prion diseases, causing devastating brain pathology. These diseases are characterized by both neuronal death in vulnerable brain regions and accumulation of protein aggregates, sometimes extending beyond the brain (Figure 2).

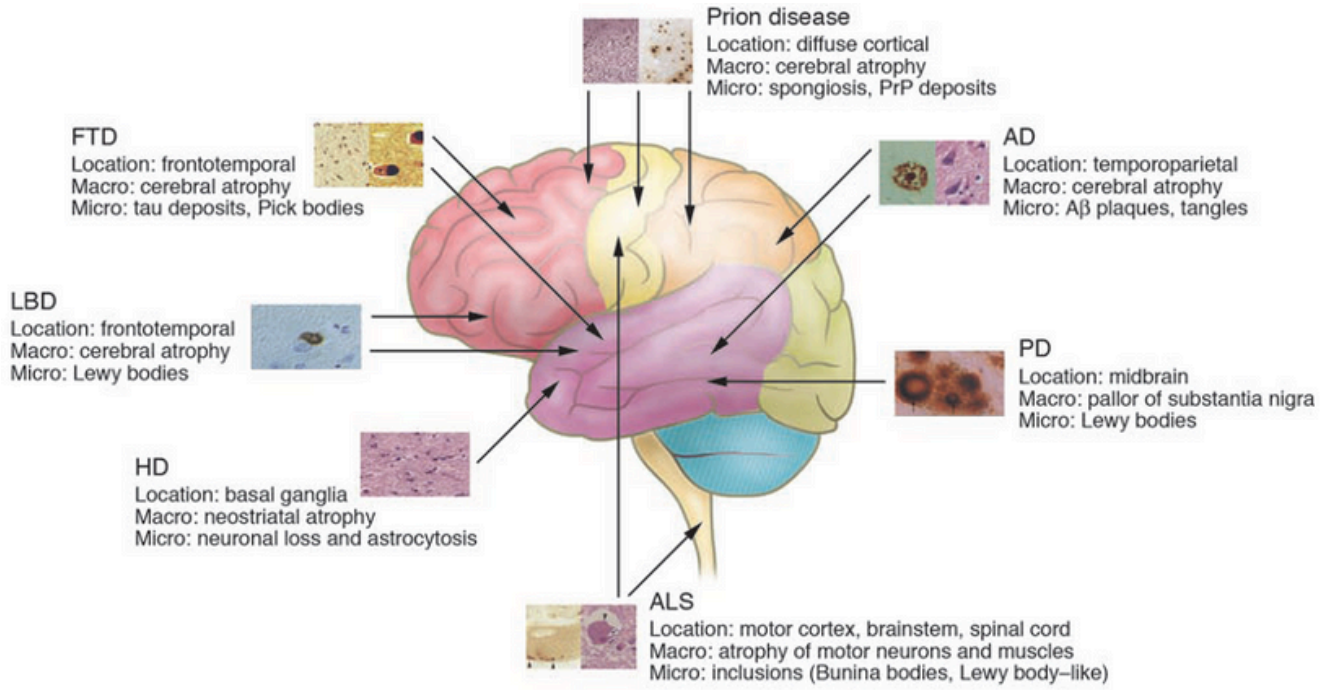


Figure 2. Major neurodegenerative disorders and associated pathologies. Adapted from (7).

Etiology of Complex Diseases and Lack of Effective Therapies

PD and AD have been described many decades ago. However, we still lack therapies that can halt or reverse progression, despite thousands of clinical trials already conducted.

We know that genetic factors explain only a small fraction (~15%) of cases, with complex diseases resulting from interactions of multiple genetic variants and environmental factors. Aging remains the major risk factor, with epigenetic alterations and environmental triggers contributing to neurodegenerative pathology in ways we still do not fully understand. Therefore, there is tremendous need for a better understanding of the biochemical processes involved, in the hope that this could lead to the development of effective therapies.

From James Parkinson to a Biological Definition of PD

PD was first described in 1817, with later refinements defining bradykinesia as a key feature. Diagnosis usually relies on motor symptoms, but non-motor signs precede diagnosis by years, and suggest the involvement of multiple brain regions beyond the substantia nigra. Advances in genetics, neuroimaging, pathology, and molecular biology support viewing PD as a syndrome comprising multiple biologies. This understanding requires the use of diverse biomarkers and criteria for precision diagnosis and subtype differentiation, as proposed by international research collaborations in which I have also had the privilege of participating (8).

Synucleinopathies: the Problem that is Keeping me Awake at Night

The etiology of PD involves a myriad of mechanisms, including mitochondrial dysfunction, oxidative stress, neuroinflammation, and proteostasis impairment. Alpha-synuclein aggregation into Lewy bodies is a central pathological hallmark of Lewy body diseases, a group that belongs to the broader group of synucleinopathies.

The Braak hypothesis posits that, during disease progression, there is sequential spread of Lewy pathology throughout the brain (9). Intriguingly, exceptions to this hypothesis exist, and causality between alpha-synuclein pathology/spreading and disease remains debated. Nevertheless, genetic evidence implicates alpha-synuclein, with mutations and gene multiplications confirming its pivotal role. The study of synucleinopathies is what is currently keeping me "awake at night", and very busy during the day.

The Biochemistry of Post-Translational Modifications and Parkinson's Disease

One of my research interests has been the study of how post-translational modifications (PTMs) modulate protein conformation and aggregation. In this context, we have been heavily studying how glycation, a non-enzymatic sugar modification, affects alpha-synuclein biology and pathobiology, linking PD with diabetes, a condition known to increase PD risk. Methylglyoxal, a reactive glucose metabolite, glycates lysine residues of alpha-synuclein, promoting oligomerization and toxicity in yeast, human cells, iPSCs, flies, and mice (10-11), and increases neuroinflammatory responses. Therefore, we have been exploring whether reducing glycation might be a viable option to restore proteostasis.

Strikingly, we found that using pharmacological agents in alpha-synuclein transgenic *Drosophila* improved motor phenotypes and reduced protein glycation, also confirmed in cellular models. These findings suggest that targeting glycation holds promise for synucleinopathies, and this is an avenue we continue to pursue in my laboratory.

Conclusions

The studies mentioned above represent a fraction of our long-term efforts in studying protein aggregation and the associated cellular responses.

Using basic molecular models is essential for testing hypotheses and understanding disease mechanisms, but these efforts must be complemented with studies in more complex models mimicking the cellular and genetic environments of the human brain.

In summary, I am confident that understanding the biochemistry of neurodegenerative diseases will pave the way to advancing treatments addressing not only symptoms but, more importantly, the underlying causes of neurodegenerative diseases.

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SPB Activities

2nd FEBS Workshop on Redox Medicine: Connecting the Exposome with Redox Regulation in Health and Disease

Luso, October 6-9, 2025

Report by Ana Ledo and Bárbara Rocha, University of Coimbra, on behalf of the SPB thematic group Redox Biology and Oxidative Stress

The event brought together more than 50 participants to discuss emerging insights into the complex interactions between the external environment and biological systems, collectively referred to as the exposome.

The workshop highlighted the latest findings on redox regulation across biological functions—from fundamental research to clinical studies and therapeutic applications. It also featured sessions on advanced tools and methods for identifying and quantifying biological oxidants in complex systems.

Fig 3. 2nd FEBS Workshop on Redox Medicine
Luso, Portugal

I Young Biochemist Meeting

Coimbra, November 21 -22, 2025

Report by Vitória Baptista, University of Minho and University of Cambridge, UK, on behalf of the SPB Junior Section

The Junior Section of SPB organised the I Young Biochemist Meeting at the University of Coimbra, marking the first scientific meeting fully led by the junior section and dedicated to connecting early-career researchers. This milestone edition gathered national and international young scientists, strengthening collaboration and the community within the field. The program featured six thematic sessions ranging from industrial innovation and computational biochemistry to disease mechanisms, environmental applications and fundamental biochemical processes, showcasing the research led by emerging biochemists.

In addition, participants benefited from two hands-on workshops: Pitch Perfect: How to Present Yourself and Your Science with Impact and Biosciences Education, as well as an interactive career-focused round table, creating valuable opportunities for professional development and skill-building.

Outstanding contributions were celebrated during the meeting: Alice Mourão (MIA) won the best oral presentation award, sponsored by Alfagene, in addition to free enrolment for next year's SPB Congress. Miguel Correia (i3S) received the best poster prize, sponsored by FEBS Letters, and Ana Sofia Boasinha (BioISI) earned an honourable mention for her flash talk.

This first edition marked an important step in empowering the next generation of biochemists and establishing a strong network of young researchers within the SPB community.

Fig 4. I Young Biochemist Meeting
Coimbra, Portugal

Calendar & Events

25 - 29/03

FEBS Education and Training Conference 2026
Kuşadası, Türkiye
LINK

30/05 to 04/06

EUROMIT 2026
Angers Convention Centre, France
LINK

02-04/07

FEBS Young Scientists' Forum
Wageningen, the Netherlands
LINK

04-08/07

The 50th FEBS Congress
Maastricht, the Netherlands
LINK

31/08 to 04/09

25th European Conference on Computational Biology
Geneva, Switzerland
LINK