NEWSLETTER

SOCIEDADE PORTUGUESA DE BIOQUÍMICA

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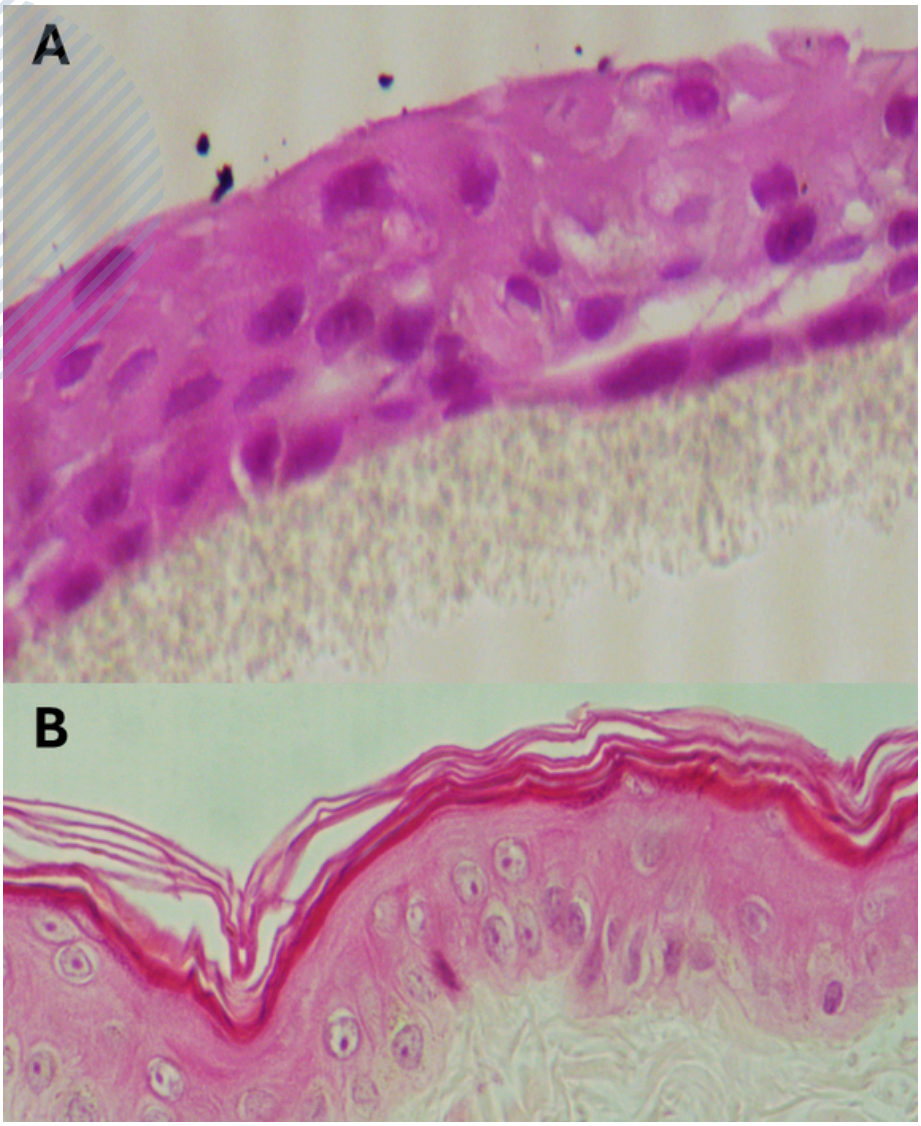

Histological slides of synthetic skin developed in air-lift cell culture (A) versus normal skin biopsy (B). Epidermis is colored by hematoxylin & eosin (nuclei are colored in purple and extracellular matrix and cytoplasm in pink).

Célia M. Antunes
Escola de Saúde e Desenvolvimento Humano
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IN THIS EDITION

Editorial

8th Edition

In this Edition:

In this issue of the SPB Newsletter, Pedro Moradas Ferreira, from the University of Porto, tells us about his academic career, his scientific activities and his contributions to biochemical education and to SPB.

Pedro Oliveira and Marco Alves, from the University of Aveiro, share their insights into the molecular pathways involved in male fertility.

This newsletter also highlights the opinion of Margarida Gama Carvalho, from the University of Lisbon, on the role of GenomePT in supporting Portuguese science, as well as upcoming events, including the 2nd FEBS Workshop on Redox Medicine.

The SPB Directive Committee

Interview

Pedro Moradas Ferreira

For this edition of the Newsletter, we talked to Pedro Moradas Ferreira, Full Professor (retired) at ICBAS, University of Porto, and member of the Yeast Signaling Networks group at i3S.

Can you tell us about your scientific career?

I started my scientific career by working at the Gulbenkian Institute of Science in Oeiras, where I carried out a research project in biochemical pharmacology. That was the final report of the 5-year degree in Chemistry and Biochemistry at the Faculty of Sciences of the University of Lisbon (1974). After my graduation I worked in the Biochemistry Department, University College London, where I obtained the PhD degree in 1977.

I returned to Portugal and joined the newly established Abel Salazar Institute of Biomedical Sciences. I began teaching biochemistry to medical students and later also biochemistry students when the Biochemistry degree was created.

A few years later, I was promoted to Full Professor. Aiming to learn new methods and update my knowledge, I spent some periods in foreign laboratories, such as the Université Libre de Bruxelles (EMBO grants) and at the Vrig Universiteit of Amsterdam (European Commission grant).

I was appointed one of the Portuguese delegated in the COST program of the EU, and I was elected chair of the committee for a 3-year period. I also served in the Portuguese delegation in Health Sciences of the framework program, and in the evaluation of EU grants and Portuguese applications.

What motivated you to study oxidative stress responses and ageing?

I started a research group focused on understanding the mechanisms underlying oxidative stress responses. This initiative was driven by several reasons, including the limited knowledge about the effect of reactive oxygen species (ROS) and the cellular adaptations to their presence.

The yeast is an eukaryotic cell that consumes oxygen and undergoes aging and cell death, in a manner that resembles other eukaryotic cells. In aging cells, the activity of antioxidant defenses is altered, and ROS can oxidize proteins, which are repaired or degraded.

The impact of hydrogen peroxide, a key ROS, is influenced by proteins involved in regulating its production and cellular targeting.

What were your main scientific contributions?

Using the yeast *Saccharomyces cerevisiae*, my research group characterized adaptive responses to oxidative stress conditions. We identified antioxidant defenses that are limiting factors for survival under hydrogen peroxide stress, as well as proteins that become oxidized (carbonylated) and inactivated in these conditions. In addition, we demonstrated that the activity of the mitochondrial superoxide dismutase (MnSOD) plays a crucial role in ethanol resistance.

In the yeast *Kluyveromyces marxianus*, my group identified a 37 kDa glycolytic protein – glyceraldehyde-3-phosphate dehydrogenase (GAPDH) – that accumulates in the cell wall and plays a role in cell flocculation.

This discovery contributed to the recognition of GAPDH as a moonlighting protein, with multiple, distinct functions beyond its classic role in glycolysis, participating in diverse cellular processes.

You contributed to biochemistry education. What were the outcomes of your involvement?

I organised a Symposium dedicated to discussing the teaching and learning of biochemistry across the different courses that were lectured in Portugal. For the first time, the majority of lecturers from different Faculties came together in a single event.

The meeting was sponsored by the Biochemical Education Committee of the IUBMB, and several distinguished international biochemists were present, including Prof. Frank Vella and Prof. Edward Wood. The meeting was followed by visits to Faculties at the University of Coimbra and the University of Lisbon. Later, I was invited to join the committee.

We decided to introduce problem based learning as a teaching approach, which was very innovative at the time.

I was a member of the committees responsible for establishing the Biochemistry degree, and later also the Bioengineering degree at the University of Porto.

I also started the ERASMUS exchange programme, establishing partnerships with several universities across Europe, including the University of Leeds, the University of Aarhus, the University of Szeged, the University of Parma, Stockholm University, the University of Madrid, the Free University of Amsterdam, Paris VI and University of Bergen.

What was the greatest challenge you have faced?

The greatest challenge that I faced occurred when on 5th March 1992, a fire broke out in the building of the Abel Salazar Institute.

The research laboratory I had recently set up was destroyed by the water and the flames. Equipment and facilities were lost and thus I had two options: raise funds to restart our research program or stop the research projects. I decided for the first option.

Thanks to the help of colleagues and companies, we managed to secure funding and restart our work successfully. I have to confess it was a tough period, but the team working under my supervision was outstanding.

What about your contributions to scientific societies, namely to SPB?

I served as a delegate of the Portuguese Biochemical Society to the Biochemical Education group of FEBS, and I was vice chair of SPB during the presidency of Alexandre Quintanilha.

I contributed to reorganizing the society, including the creation of its official logo. I also participated in the organization of SPB congresses in several occasions and I was a delegate of the society at several meetings of both FEBS and IUBMB.

What message would you like to convey to young people dedicated to Biochemistry who want to continue doing research?

If you love what you are doing and you are addressing a topic that challenges you, then fight to continue! Fight to work in a stimulating environment, and publish your data, therefore contributing to new knowledge. Select a team that is performing innovative research work and be resilient.

News & Views

The molecular pathway to male fertility: insights from testicular and spermatozoa biochemistry

Pedro F. Oliveira, Department of Chemistry, University of Aveiro
Marco G. Alves, Department of Medical Sciences, University of Aveiro


Pedro F. Oliveira


Marco G. Alves

The Global Significance of Reproductive Biochemistry

Reproductive biochemistry is increasingly important for addressing global health challenges like infertility. According to the WHO, male factors contribute to about 50% of infertility cases, but a significant portion (30-40%) are "idiopathic", lacking an identifiable cause. This highlights the need for a deeper understanding of male reproductive function.

Male infertility is not an isolated condition since it can be a sign of systemic health issues. In fact, infertile men have a higher risk of developing comorbidities like endocrine, respiratory, and cardiovascular conditions later in life.

Therefore, a deeper biochemical understanding of male reproductive health provides insights into a man's overall physiological state. Much like mRNA vaccines relied on decades of fundamental research, new infertility diagnostics and treatments require a strong investment in basic biochemical research. By understanding the mechanisms of reproductive fitness, researchers create the blueprints for tackling related pathologies.

This work is crucial, especially as lifestyle and environmental stressors increasingly disrupt these processes.

From "Idiopathic" to Understood: A Biochemical Contribution to Male Fertility Research

Understanding male fertility requires a deep look at the sophisticated testicular microenvironment. While tissue analysis offers a visual guide, the real importance lies in the complex biochemical phenomena within its structures. The seminiferous tubules are the primary site of spermatogenesis, the process of sperm development.

This process showcases cellular and molecular coordination within a unique, protected space. The tubules have two cell types: germ cells that mature into spermatozoa, and somatic Sertoli cells that provide essential support. These "nurse cells" guide developing germ cells through their differentiation. A critical feature is the blood-testis barrier, formed by tight junctions between Sertoli cells.

This barrier isolates germ cells from the bloodstream, protecting them from immune attack and harmful substances. The interstitial space also contains Leydig cells, which produce testosterone, a vital hormone for male fertility. The interplay between these structures shows why studying the testes demands a multi-level approach. By focusing on molecular changes like metabolism and stress response, research reinforces the importance of unraveling the biochemical basis of male reproductive health.

Recent work in the field of male fertility has made a strong contribution to decoding its molecular mechanisms, moving beyond descriptive observations to establish a clear causal link between systemic metabolic disorders and specific, local biochemical dysfunctions in the testes. A key focus has been the shift between "idiopathic" cases of male infertility into the realm of biochemically characterized pathologies.

Detailed data on metabolic pathways essential for male fertility highlighted how systemic conditions like obesity can profoundly impair reproductive function.

New findings revealed how high-energy diets can directly alter the testicular metabolic profile and negatively impact male reproductive parameters. At the cellular level, discoveries also showed that hyperinsulinemia can disrupt the endocrine activity of Sertoli cells and lead to DNA damage in sperm, inhibiting spermatogenesis.

These scientific contributions, characterized by a rigorous blend of methodologies, from studying in vitro cultures of testicular cells to in vivo models, followed by a detailed analysis of the underlying biochemical phenomena, allowed for the identification of key molecular pathways that modulate testicular function and the exploration of how therapies might counteract the negative impacts of endogenous and exogenous stressors.

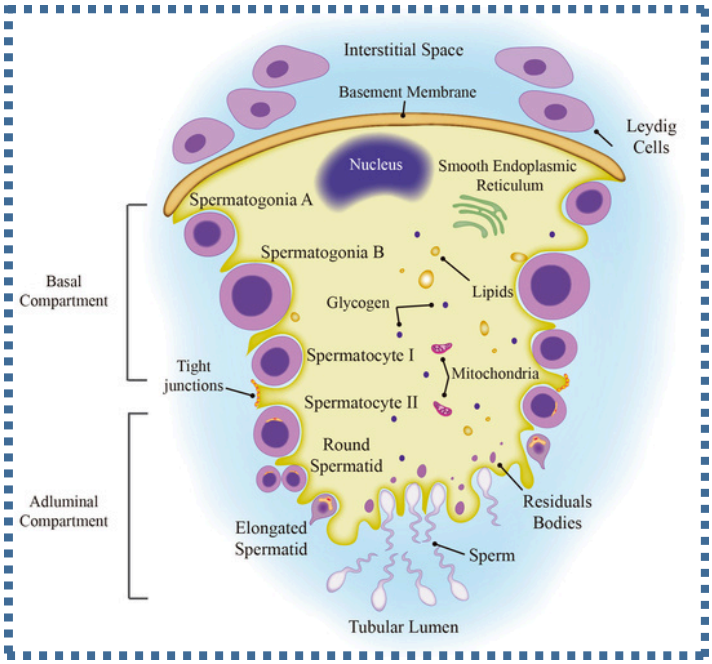

Fig 1. Schematic representation of a section of a seminiferous tubule illustrating spermatogenesis.

Broader Impact and Future Horizons

Insights from male fertility research can drive future innovations in diagnostics and therapeutics. By pinpointing molecular and metabolic changes in conditions like obesity-induced infertility, recent work has laid the groundwork for new diagnostic tools. For instance, identifying specific biomarkers in semen or testicular tissue could lead to more accurate and less invasive tests.

This knowledge also enables targeted therapies to counteract identified biochemical dysfunctions. The field is moving toward a multidisciplinary approach, as the complexity of male fertility pathways—from hormonal signaling to genetic factors—requires sophisticated analysis of large datasets.

Future research will integrate biochemical expertise with advanced computational tools to uncover the remaining "idiopathic" infertility causes. Long-standing collaborations between researchers with different backgrounds are vital for tackling these complex biological questions.

To learn more:

- WHO Infertility - Key facts (https://www.who.int/news-room/fact-sheets/detail/infertility)
- Male infertility - EAU Guidelines on Sexual and Reproductive Health - UROWEB (https://uroweb.org/guidelines/sexual-and-reproductive-health)
- Carrageta, D. F., Pereira, S. C., Ferreira, R., Monteiro, M. P., Oliveira, P. F., & Alves, M. G. (2024). Signatures of metabolic diseases on spermatogenesis and testicular metabolism. Nature Reviews Urology, 21(8), 477-494.
- Oliveira, P. F., Cheng, C. Y., & Alves, M. G. (2017). Emerging role for mammalian target of rapamycin in male fertility. Trends in Endocrinology & Metabolism, 28(3), 165-167.
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- Rato, L., Alves, M. G., Socorro, S., Duarte, A. I., Cavaco, J. E., & Oliveira, P. F. (2012). Metabolic regulation is important for spermatogenesis. Nature Reviews Urology, 9(6), 330-338.

GenomePT – Building a National Infrastructure for Genomics in Portugal

Margarida Gama Carvalho, Faculty of Sciences, University of Lisbon
GenomePT National Coordinator

Modern science increasingly depends on advanced technological platforms and structured services. Genomics exemplifies this trend, requiring major investment in sequencing technologies, computational infrastructures, and specialized expertise.

The European Strategy Forum on Research Infrastructures (ESFRI), created in 2002, addressed this need by publishing long-term roadmaps for pan-European infrastructures and setting investment priorities. Inspired by this model, Portugal launched its national roadmap in 2014, identifying 40 strategic infrastructures, including the National Laboratory for Genome Sequencing and Analysis – GenomePT.

Initially coordinated by Prof. Manuel Santos (University of Aveiro), GenomePT was established as a distributed platform of 12 nodes, bringing together major academic institutions with expertise in genomics from North to South: Universities of Minho, Porto (through IBMC, IPATIMUP, CIBIO), Aveiro, Coimbra, Lisboa (through the Institute of Molecular Medicine), and Algarve, together with Biocant (Cantanhede), the Gulbenkian Institute of Science, and the National Health Institute Dr. Ricardo Jorge (INSA).

From the outset, the consortium spanned domains with strong societal impact: health, where genomics plays a central role in genetic diagnostics, precision medicine, and pathogen surveillance; biodiversity and environment, supporting conservation and sustainability strategies; and agriculture, industry and biotechnology, promoting innovation through reliable genomic data.

Its mission was to advance genomics in Portugal, translating expertise into value and providing essential support to the research community through services and training. A decisive moment came in 2017, when a funding call dedicated to the national roadmap for research infrastructures (RNIIE) allowed GenomePT to secure €3.9M from Portugal2020, enabling the installation of five sequencers, facility upgrades, computational improvements, and recruitment of specialized staff. This supported the evolution of GenomePT into an infrastructure capable of delivering a wide range of sequencing and analysis services and consolidating advanced training nationwide.

Between 2017 and 2021, the consortium expanded with three new nodes and delivered impressive outputs: nearly 250,000 genome samples, 6,200 transcriptomes, and 5,000 genotyping/cytogenetic assays. Over 34,000 internal requests and 37,000 external services were processed for 229 institutions, including universities, hospitals, and companies.

During the COVID-19 pandemic, GenomePT played a key role in the national SARS-CoV-2 genomic surveillance program, collaborating with INSA to sequence hundreds of viral samples.

Despite this demonstration of critical relevance, expectations for continued support were unmet. Since 2021 there have been no direct public investments in RNIIE, deeply compromising sustainability and threatening not only previous financial investments but also the scientific and infrastructural gains they enabled. Regional or institution-focused funds cannot replace a coordinated national strategy, particularly in genomics - a field where equipment is costly and short-lived, and where privacy-sensitive data requires robust frameworks. The growing reliance on foreign private companies for genomic services should, at the very least, be a cause for concern.

Notwithstanding these challenges, GenomePT stands today as a mature national asset with proven capacity, expertise, and a strong collaborative foundation. Under renewed coordination, in 2025 and with IPO-Porto, University of Beira Interior, FCT-NOVA, and Faculty of Sciences, Univeristy of Lisbon as new partner institutions, GenomePT is entering a new phase, committed to supporting Portuguese science and innovation with world-class genomic resources.

Beyond service provision, GenomePT has been active in promoting dialogue and community building. Since 2018, the consortium has organized annual symposia, gathering around 100 participants each year to discuss advances in sequencing technologies and their applications across health, biodiversity, and biotechnology.

These meetings have been instrumental in strengthening ties between researchers, clinicians, and industry, while keeping the community aligned with international trends.

For colleagues interested in exploring the potential of genomics in their projects, the simplest entry point is to reach out directly to GenomePT nodes, who can advise on available services and collaborations.

While our central website is currently under update and social media channels are being restructured, the consortium remains committed to keeping its expertise accessible and to fostering greater awareness of the value of genomics across health, biodiversity, and innovation, promoting best practices and actively contributing to strategic policy development in this field.

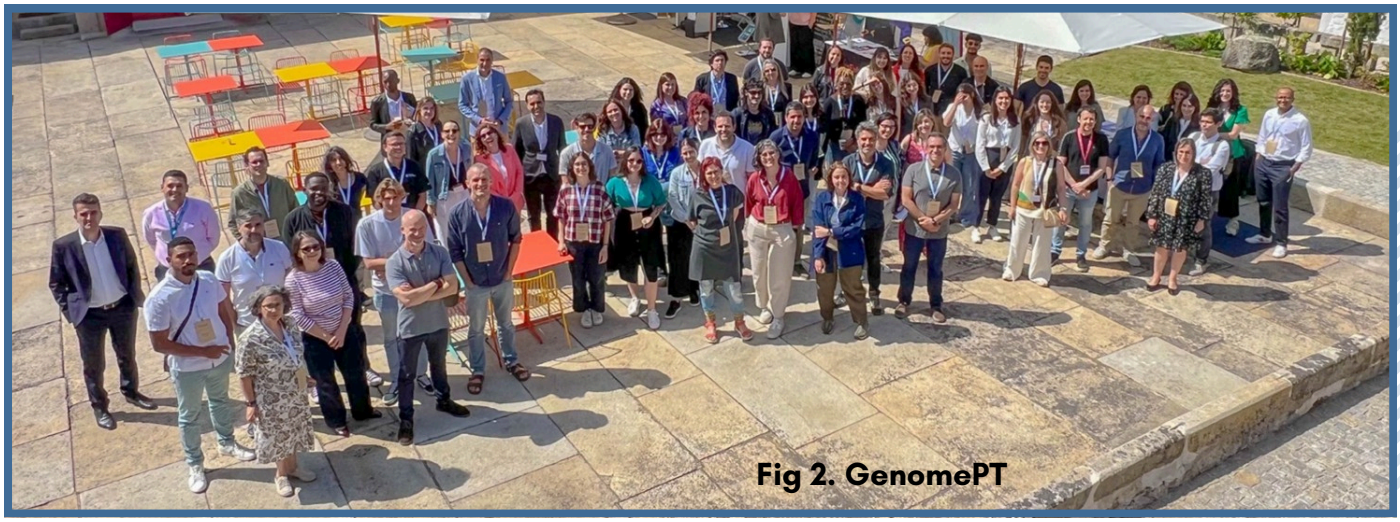

Fig 2. GenomePT

Calendar & Events

06-09/10

2nd FEBS Workshop on Redox Medicine
Luso, Portugal
LINK

29-31/10

RNA Horizons 2025 Therapeutics Symposium
Palermo, Sicily, Italy
LINK

16-20/11

11th International Symposium on Autophagy
Lorne, Victoria, Australia
LINK