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Editorial

Reinventing the PhD: A Hybrid Model for a World in Crisis

Nelson Santiago Vispo [1], Hortensia Rodríguez [2] Fernando Albericio [3]*

[1]Clinical Biotec SL. and Bionatura Journal. Madrid. 28029. Spain. Member of the Scientific Board, Bionatura Journal (role declared for transparency only).*
[2] Medicinal Chemistry Research Group (MedChem–YT), Yachay Tech University, Urcuquí 100119, Ecuador. Member of the Scientific Board, BioNatura Journal (declared for transparency only).
[3] Peptide Science Laboratory, School of Chemistry and Physics, University of KwaZulu-Natal, Durban, South Africa. Member of the Scientific Board, BioNatura Journal (declared for transparency only).
**Correspondence: santiago@clinicalbiotec.com*

ABSTRACT

Doctoral education is undergoing a structural crisis. While the PhD remains the highest academic qualification, the global mismatch between the number of doctoral graduates and the availability of research careers has reached unsustainable levels. This editorial synthesizes comparative evidence from Asia, Europe, and Latin America to illustrate the paradox of societies that increasingly depend on scientific solutions while doctoral programs remain poorly aligned with real-world needs. We argue for a new model—the Hybrid Professional Doctorate (PhD 2.0)—that preserves academic rigor while integrating professional immersion, interdisciplinary training, and impact-oriented outputs. Successful initiatives in Catalonia, Germany, and the Netherlands show the feasibility of this model. Transforming doctoral education is essential to ensure relevance, employability, and societal benefit in the twenty-first century.

Keywords: Doctoral reform; PhD crisis; Hybrid doctorate; Employability; Science policy; Interdisciplinary training; Innovation capacity.

Editorial

The global landscape of doctoral education is at a critical turning point. Although the PhD continues to symbolize the highest level of academic training, the widening gap between the number of doctoral graduates and the availability of research positions has become deeply destabilizing. This imbalance threatens not only individual career trajectories but also the scientific and technological capacity on which modern societies depend for public health, environmental resilience, and economic development.[1–3]

The pattern is consistent across regions: *more PhDs, fewer research careers*. China awarded more than 600,000 doctorates in 2023, yet fewer than one-third of graduates will enter research-related positions.[7] Southern Europe experiences similar pressures. Spain and Portugal consistently produce more doctoral graduates than their academic ecosystems can absorb, resulting in long-term precarity, geographic mobility, and structural underemployment.[4–5,8–9] Across Latin America, limited scientific infrastructure and scarce demand for advanced research skills drive highly trained professionals to migrate or shift to unrelated sectors.[6,10]

This situation reveals a deeper paradox: societies increasingly require scientific expertise to address urgent challenges, yet current doctoral structures fail to prepare researchers for the environments where they are most needed.

The traditional PhD—publication-driven, discipline-bound, and institutionally siloed—was designed for a world that no longer exists. Today's systemic challenges, including infectious diseases, microbial water contamination, climate variability, soil degradation, food insecurity, and biodiversity loss, demand professionals capable of crossing disciplinary boundaries and bridging academia with government, industry, and civil society.

Comparative Indicators of Doctoral Education

Country	Avg. duration (years)	% Non-academic employment	Salary ROI vs. Master's
China	4–6	~70%	–12% (Humanities)
Germany	5	80%	+18% (STEM)
USA	6	75%	+5% (average)
Spain	4–5	68%	+3% (STEM only)
Portugal	4	70%	0%
Latin America	4–6	>75%	Negative

Source: OECD, UNESCO, UKRI, CRUE, MOST China, FJI, OECD-LAC.[2–14]

Table 1. Comparative indicators of doctoral education in selected countries (2025).

Beyond these indicators, the traditional academic pipeline—PhD → postdoc → permanent position—has become the exception rather than the rule. Most PhD graduates will build careers outside academia, yet doctoral training rarely equips them with the competencies needed for roles in public health agencies, environmental laboratories, biotech companies, startups, NGOs, municipal governments, or policy institutions.

The world now requires researchers who can operate within and beyond academia, design actionable solutions rather than focus exclusively on publications, and collaborate across sectors to address interconnected challenges in health, climate, agriculture, and urban resilience.

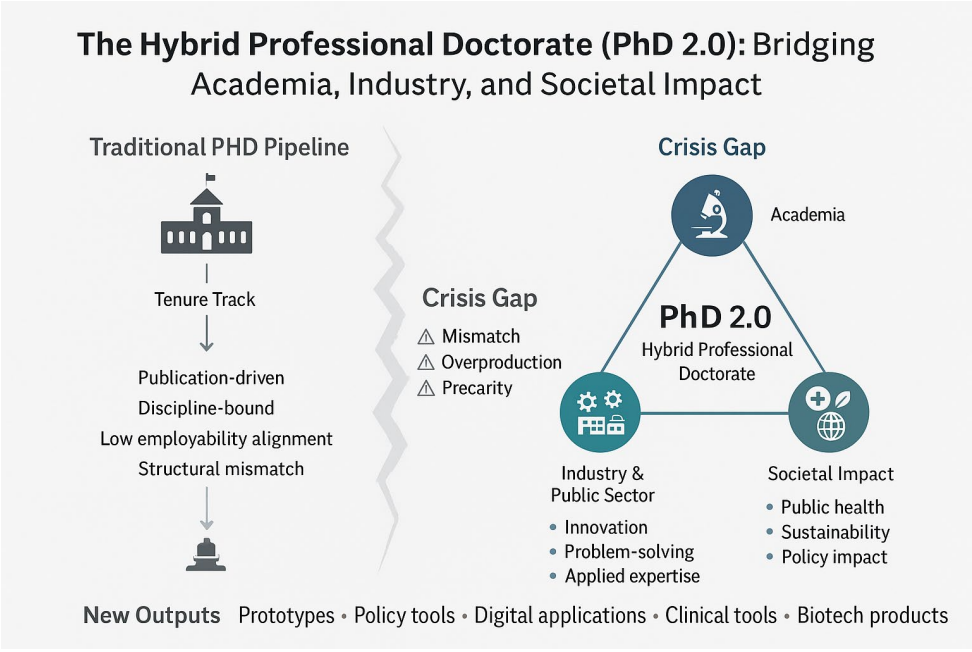

Figure 1. Conceptual model contrasting the traditional PhD pipeline with the proposed Hybrid Professional Doctorate (PhD 2.0).

The diagram illustrates the structural limitations of the conventional academic pathway, the emerging crisis gap affecting doctoral careers, and the interconnected components of the PhD 2.0 model, which integrates academia, industry/public sector, and societal impact.

The Case for PhD 2.0

A shift in doctoral education is urgently needed. We propose the **Hybrid Professional Doctorate (PhD 2.0)**, a model that preserves academic rigor while expanding its purpose to include direct societal impact.

Its core components include:

- **Structured professional immersion** in real-world environments (e.g., hospitals, water laboratories, environmental agencies, innovation hubs).
- **Dual supervision** by academic mentors and professional-sector experts.
- **Transdisciplinary training** aligned with national and regional priorities.
- **Impact-oriented outputs**, such as prototypes, policy tools, environmental interventions, public health platforms, or digital applications.
- **Evaluation metrics** that value societal contribution alongside scientific publications.

In essence, the PhD 2.0 forms professionals who can not only analyze systems but also actively transform them.

Promising examples already exist. Catalonia's Industrial Doctorate Programme has strengthened employability and catalyzed university–industry collaboration.[15] Similar dual models in Germany and applied PhDs in the Netherlands have demonstrated strong outcomes. Yet such initiatives remain limited outside Europe and almost absent in Latin America, where the gap between scientific capacity and socioeconomic needs is particularly wide.[13]

Several countries in the region—Ecuador, Colombia, Brazil—have launched early efforts to link doctoral training with public-sector or industry partners. However, scaling these experiences requires integrated policies, mixed funding schemes, and updated quality standards that recognize applied scientific contributions. A regional PhD 2.0 pilot program in areas such as public health, food safety, climate adaptation, or energy transition would demonstrate the value of hybrid doctoral training for national development.

CONCLUSION

The scientific themes showcased in this issue of *BioNatura Journal*—preeclampsia monitoring, vector-borne diseases, hydro-geophysical characterization, water contamination, food safety, soil microbiomes, environmental risk, and urban vulnerability—underscore the urgent need for applied scientific leadership. These are precisely the domains where the traditional doctoral model falls short.

Reforming the PhD is not a threat to academic tradition. It is a necessary evolution to preserve the relevance, legitimacy, and societal value of science itself. A new doctoral paradigm—hybrid, transdisciplinary, and impact-oriented—is essential to train professionals capable of leading scientific innovation in public health, environmental resilience, biotechnology, and sustainable development.

The world does not need more PhDs. It needs PhDs with purpose.

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Additional Information

Correspondence should be addressed to:

Nelson Santiago Vispo

Clinical Biotec S.L. & BioNatura Journal, Madrid, Spain

Email: santiago@clinicalbiotec.com

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