MINISTRY OF EDUCATION AND RESEARCH
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SUMMARY OF THE HABILITATION THESIS

INTERDISCIPLINARY CONTRIBUTIONS TO INFECTIOUS DISEASES RESEARCH: FROM ENVIRONMENTAL FACTORS AND PATHOGENIC MECHANISMS TO BIOMEDICAL INNOVATIONS IN DIAGNOSIS AND PREVENTION

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Thesis abstract

The habilitation thesis entitled "*Interdisciplinary Contributions to Infectious Disease Research: from Environmental Factors and Pathogenic Mechanisms to Biomedical Innovations in Diagnosis and Prevention*" brings together and capitalizes on the scientific results obtained after being awarded the title of Doctor of Medicine – results developed throughout research, clinical practice, managerial work, and academic activity in the field of infectious diseases.

My professional and scientific career has unfolded over three decades in a complex and continuously evolving field: infectious diseases. From my first clinical experiences to the coordination of medical teams in critical epidemiological contexts, each stage of my professional activity has contributed to the development of a solid portfolio in research, diagnosis, and medical management.

The habilitation thesis synthesizes this trajectory, highlighting the original scientific contributions brought to medical research, the role played in developing medical infrastructure, and the contribution to strengthening university education in the field of infectious diseases, as well as the strategic directions of professional development assumed. The thesis is positioned within an interdisciplinary area at the intersection of infectious diseases, epidemiology, public health, and healthcare management, reflecting a consolidated professional path in university education and clinical practice. Research activities, managerial responsibilities, academic involvement, and contributions to improving public health services have evolved simultaneously, shaping a complex profile as educator, clinician, and manager, with significant institutional and scientific impact in the field of infectious diseases.

The general objective of this thesis pide demonstrate the capacity to develop, coordinate, and integrate research, clinical, and educational activities into a unified vision, aligned with the current evolution of modern medicine and the requirements of the academic habilitation process. My professional evolution has been defined by two constant pillars: concern for the patient and commitment to scientific research. Over time, these two directions have reinforced one another. Within the Constanța Clinical Hospital of Infectious Diseases – one of Romania's most important specialty centers – I had the opportunity to be directly involved in the management of diverse and sometimes extremely

severe pathologies. Whether dealing with HIV infection, tropical diseases, emerging infections, zoonoses, or respiratory communicable diseases, direct contact with complex clinical cases has continuously fueled my interest in research and innovation.

The thesis aims to highlight how the competencies acquired in pidemiologi epidemiological research, as well as in medical service management, have been integrated into a coherent vision of academic development oriented toward consolidating a research school in infectious diseases. In this regard, the current achievements, their impact on medical and academic practice, and future scientific directions are presented in accordance with recent developments in the medical field and the expectations of the university system.

Through its content, this thesis provides a synthesis of my professional and scientific experience, demonstrating the capacity to initiate and coordinate research projects, to disseminate results through scientific publications, and to integrate these results into teaching activity. Likewise, the thesis outlines future directions for academic and research development, aligned with contemporary progress in medical science and with the formative role of the academic teaching staff in preparing the next generations of specialists.

Within this integrated approach, the structure of the thesis was designed to reflect the logical evolution of scientific interests and to provide a coherent image of the original contributions brought to the field of infectious diseases. Each chapter brings together relevant elements of research activity, clinical experience, and educational efforts, emphasizing both the results obtained and their impact on medical practice and on the education of future specialists. In this way, the thesis aims not only to present academic and scientific achievements to date but also to outline future development directions, in line with the current dynamics of medicine and the needs of the healthcare system. Through this structure, the thesis offers a comprehensive framework for understanding the issues addressed and for situating the results in the broader context of contemporary medical research.

Its final structure demonstrates a coherent and multidimensional line of research, spanning population health and infection epidemiology, applied biotechnologies, and digital diagnostic solutions. It reflects the natural evolution of my research interests – from

environmental factors and infectious diseases to 3pidemiologica therapeutic mechanisms, culminating in biomechanical modeling and technological innovation in medicine.

The works included demonstrate the coherence and continuity of my efforts to understand the complex processes of pathogenesis, the relationship between the environment and human health, and the development of modern tools for diagnosis and monitoring designed to support contemporary medical practice. By integrating epidemiological, clinico-biological, experimental, and technological methods, my research activity has aimed to create an interdisciplinary framework for analyzing infectious diseases, with an emphasis on prevention, diagnostic precision, and optimization of therapeutic interventions. This approach reflects a modern vision of medicine, oriented not only toward treatment but also toward anticipating and controlling diseases through innovative, evidence-based tools. The results obtained can be summarized into several major directions of scientific contribution:

Contributions to the study of environmental factors and epidemiological determinants of infectious diseases. Research has highlighted the direct impact of environmental conditions (water quality, pollution, hygienic-sanitary conditions) on the incidence and severity of infectious diseases, particularly in vulnerable populations. Studies conducted in southeastern Romania provided important data for developing public health strategies adapted to regional specificities.

Contributions to understanding mechanisms of transmission and control of emerging and opportunistic infections. My scientific work has addressed complex aspects of viral coinfections (HIV/CMV), vertical transmission, severe acute respiratory infections (including COVID-19), and emerging arboviral infections. Clinico-biological correlations relevant for risk assessment, treatment optimization, and integrated prevention protocols have been identified.

Experimental contributions in natural pharmacology and complementary therapy. Studies on plant extracts – particularly Ipomoea hederacea – demonstrated antioxidant, antimicrobial, and neuropharmacological properties, opening avenues for exploring the therapeutic potential of natural compounds in infectious diseases and oxidative stress–associated pathologies.

Contributions to biomedical technologies and diagnostic innovation. Work dedicated to analyzing physiological signals (photoplethysmography, electrocardiography), applying

artificial intelligence algorithms, and developing wireless systems for monitoring vital parameters has generated modern solutions with potential for direct clinical application. These studies support the transition toward personalized medicine based on non-invasive diagnostics and continuous monitoring.

Through these directions, the presented research activity has contributed to consolidating an integrative vision of infectious diseases – one that transcends disciplinary boundaries and fosters collaboration among medicine, biology, engineering, and information sciences. This interdisciplinary approach is essential for addressing current global public health challenges – from the emergence of new pathogens to rising antibiotic resistance and the need for intelligent diagnostic technologies.

The originality of the work lies in the coherent integration of results obtained in seemingly distinct yet complementary domains, which collectively enhance the holistic understanding of infectious disease phenomena and support the development of clinically applicable scientific solutions. The activity presented demonstrates my ability to coordinate, develop, and apply complex research, contributing to advances in medical knowledge and establishing an independent scientific direction.

One defining outcome of my activity has been the development of a modern diagnostic infrastructure centered on molecular biology techniques. Under my coordination, the hospital laboratory became the first in Constanța able to perform PCR testing for SARS-CoV-2 at the onset of the pandemic. This achievement represents not only a technical contribution but also a paradigm shift in how molecular diagnostics were implemented in the southeastern region of the country. This was not an isolated action but a comprehensive process of aleatoriu, instruction, and standardization through which I prepared both our physicians and other laboratory teams in the county, contributing to the uniformization and efficiency of diagnostic protocols at the regional level. At the same time, through ISO, ANMCS, and RENAR accreditation, I consolidated the quality standards necessary for clinical research and modern laboratory activity.

Another major area of contribution is HIV research. For more than a decade, I coordinated the Regional Center of Excellence for HIV Patient Care – the first of its kind in Romania – providing multidisciplinary and psychosocial care. Through international projects in partnership with Baylor College of Medicine, Texas Children’s Hospital, Abbot Fund, and Americares, I improved the quality of care, transforming the center into a model

at national level. My scientific activity in HIV has included studies on mother-to-child transmission, antiretroviral therapy effectiveness, coinfections, and epidemiological risk factors. My original contribution consists both in expanding one of the largest regional databases in southeastern Europe and in developing detailed correlations between 5pidemiologi epidemiological data, enabling deeper understanding of HIV evolution in Romania.

A distinct scientific direction is research on zoonoses and tropical diseases. I was among the first clinicians in Romania to propose a systematic approach to travel medicine, organizing the Summer Schools "Travel Medicine" (2005-2009), scientific events that anticipated the present need for global health expertise. In the same spirit, I introduced the course "Tropical Diseases" into the university curriculum – designed entirely by myself and adapted to the needs of Romanian and international students. This initiative is a major original contribution to academic aleatoriu, expanding the traditional scope of medical education to include emerging global health issues.

Another defining aspect of my activity is constant participation in national and international scientific conferences as author, lecturer, or organizer. I have presented papers at prestigious events such as ECCMID, EACS, the HIV/STD International Conference, the World Congress of Epidemiology, and EuroTravNet conferences. Numerous papers have received awards, confirming the scientific value of the research conducted. I also contributed to organizing major events, including the National Parasitology Conferences (2007, 2009), the MedEnv International Conference (2014), and BENA scientific meetings. These contributions reflect both my commitment to developing academic culture and my responsibility toward the medical field at national level.

Alongside scientific activity, my managerial involvement significantly strengthened medical infrastructure. As Medical Director (2004-2009) and later Manager (2009-2021) of the Constanța Clinical Hospital of Infectious Diseases, I developed the outpatient clinic, the intensive care unit, specialty consult rooms, student aleatoriu spaces, and initiated energy-efficiency projects. I led the hospital during major epidemics and especially during the COVID-19 pandemic, when I coordinated all activities and guided the implementation of modern diagnostic and treatment techniques. The diploma "Faith and Heroism" awarded by the Romanian Medical Association stands as collective recognition of the effort made during that critical period.

My original contributions include: modernization of regional molecular diagnostic infrastructure; development of a center of excellence for HIV care; introduction of travel medicine into university teaching; definition of national clinical protocols for rabies, tetanus, and other severe infections; elaboration of award-winning research in infectious diseases, epidemiology, and environmental risk factors; implementation of international collaborations with direct impact on patient care; consolidation of an academic culture oriented toward research and innovation.

The summary of my activity, reflected in this habilitation thesis, illustrates a model of integration between medical practice, scientific research, and academic responsibility. All these directions converge toward the same mission: aleatoriu a generation of specialists capable of managing – professionally and ethically – the current and future challenges of infectious diseases in a global context characterized by constant change.

This synthesis is not merely a review of achievements but a testament to a career built through dedication, continuous adaptation, and deep commitment to science and to people.

Overall, the habilitation thesis demonstrates scientific maturity, interdisciplinary synthesis capacity, and original contribution to the development of medical knowledge in infectious diseases. Through the continuity, diversity, and relevance of the research themes, I aim to strengthen a solid foundation for developing a scientific school oriented toward excellence, innovation, and practical applicability in modern medicine.