

UNIVERSITY OF AGRICULTURAL SCIENCES AND VETERINARY MEDICINE CLUJ-NAPOCA
DOCTORAL SCHOOL OF AGRICULTURAL ENGINEERING SCIENCES

ABSTRACT_HABILITATION THESIS

**THE IMPACT OF PROBIOTICS AND NANOPARTICLES IN
BIOTECHNOLOGICAL APPLICATIONS, FOOD SAFETY AND HUMAN
NUTRITION**

Field: **Biotechnology**

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ABSTRACT

The present habilitation thesis represents an overview of my academic and research achievements related to the use of probiotics and nanoparticles in interdisciplinary fields from the time of my doctoral thesis defense in February 2014 until the present day. This thesis also includes my proposals and plans for the development and evolution of my academic career and research activities, which constitute the necessary basis for acquiring the ability to coordinate doctoral students. Entitled "The Impact of Probiotics and Nanoparticles in Biotechnological Applications, Food Safety, and Nutrition," the thesis summarizes my most relevant personal achievements in scientific research, describing the results of representative studies for my areas of interest in research activities.

The primary research focus is on the use of biotechnologies for the applicability of probiotics and nanoparticles in various interdisciplinary fields. The present habilitation thesis is structured into three main sections, according to the criteria recommended and approved by the National Council for Attesting University Titles, Diplomas, and Certificates (CNATDCU):

Section I - Main scientific and professional achievements;

Section II - Professional development and evolution directions; and

Section III - Bibliographic references.

After a brief introduction, Part 2 (Scientific and Professional Achievements) presents the main research directions addressed, namely: (1) Innovative Systems for Immobilization of Probiotics and Their Applications in Biotechnologies; (2) Nanostructures and Probiotics - Biotechnological and Medical Applications; and (3) Biotechnological Systems with Applications in Food Safety and Human Health. Chapter 2.1. (Innovative Systems for Immobilization of Probiotics and Their Applications in Biotechnologies) presents original studies focused on probiotic and synbiotic encapsulation techniques, as well as the evaluation of their stability and viability in various biopolymers.

Firstly, the chapter presents the different encapsulation technologies available, such as microencapsulation, nanoencapsulation, and gelation encapsulation methods. These technologies allow for the protection of probiotics and synbiotics against environmental factors, such as temperature, pH, and digestive enzyme action. Furthermore, the chapter describes the various biopolymers that can be used in encapsulation technology, such as proteins, polysaccharides, and

lipids. Each biopolymer has its characteristics and properties that can influence the stability and viability of encapsulated probiotics and synbiotics.

Finally, the chapter presents the potential applications of encapsulation technologies in biotechnologies, such as improving the stability of probiotics in food products and supplements, developing cosmetic and pharmaceutical products, and using them in genetic therapy and personalized medicine. Therefore, the chapter focuses on encapsulation technologies of probiotics and synbiotics, their stability and viability in different biopolymers, and the potential applications in biotechnologies.

Chapter 2.2. (Nanostructures and Probiotics - Biotechnological and Medical Applications) includes the most representative studies published as the first/co-author on topics related to the use of nanostructures, especially nanoparticles in various medical and biotechnological applications (antimicrobial activity and impact on in vitro systems).

In biotechnologies, scientific research activities should include not only the fundamental component but also an applicability and transfer of know-how component to the economic and industrial environment. Therefore, I have always aimed to valorize fundamental research results in the development of optimized analysis techniques and methods, as well as in the development of new functional products with added value.

Articles published with this component, in addition to those already presented in previous chapters, are presented in a separate chapter. It focuses on transferring know-how and valorizing research in biotechnologies by developing new products and improved analytical methods. Thus, it is essential that fundamental research is connected to the current needs and trends of the industry to ensure efficient transfer.

In conclusion, applicability and transfer of know-how are essential components in research activity, especially in the field of biotechnology. The valorization of research results in the development of new products and improved analytical techniques can bring significant benefits to industry and consumers, contributing to sustainable and innovative development. These aspects are discussed in Chapter 2.3 (Biotechnological systems with applications in food safety and human health).

My scientific and publishing activity after the completion of the doctoral thesis can be quantified as follows: 12 chapters in international publishers, 3 textbooks, and 2 practical work guides. I have published as first or co-author 38 ISI articles (18 of which were awarded by UEFISCDI) and 15 BDI articles (Web of Science H-index = 16). Additionally, I have coordinated

3 research projects and have been a member of 27 research projects. I am a reviewer for indexed journals.

In the second part of my thesis, I present my plans for scientific, professional, and academic development and evolution. My main objective is to increase the scientific quality, visibility, and recognition of my research at the national and international levels. In my future as a researcher, I will focus my activity on two main areas: (1) the use of probiotics to transport bioactive elements with maximum absorption at the intestinal level, and (2) the synthesis and characterization of nanoparticles using probiotics and their metabolites, for use in biomedicine. These activities will be closely linked to my educational activity and the requirements of the socio-economic environment.