

# **Interdisciplinary Perspectives in Reconstructive Surgery: From Anatomy and Tissue Reconstruction to Regenerative Medicine**

## **-Abstract-**

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This habilitation thesis synthesises my professional, academic and scientific career and traces my gradual progression towards a distinct direction of development: from Anatomy and Embryology, through Orthopaedics and Traumatology, to Plastic and Aesthetic Surgery and Reconstructive Microsurgery, the specialty in which I currently practise. It highlights my principal personal contributions and outlines future directions for my professional, scientific and educational development. Throughout my career, I have sought to integrate clinical experience, biomedical research and academic work through an interdisciplinary and translational approach focused on reconstructive surgery, hand surgery and regenerative medicine.

Plastic and reconstructive surgery lies at the intersection of multiple medical and surgical specialties and requires the continuous integration of fundamental knowledge with technological advances and biomedical research findings. Advances in microsurgery, regenerative medicine, tissue engineering, biomaterials and 3D printing have considerably expanded reconstructive possibilities and provided a foundation for increasingly individualised therapeutic strategies. In this context, my scientific work has progressively concentrated on complementary, interdisciplinary research areas with translational potential and relevance to reconstructive surgery.

One of my main areas of interest has been regenerative medicine and tissue engineering, specifically the investigation of adipose-derived stem cells, biomaterials and matrices for osteochondral and nerve regeneration. Within this area, my experimental studies on peripheral nerve regeneration have focused on developing and evaluating nerve guidance conduits, including 3D-printed devices, used alone or in combination with stem cells and other biological regenerative strategies. The findings have highlighted the potential of these approaches to support the regeneration of bone, osteochondral tissue and peripheral nerves, providing a basis for regenerative therapeutic strategies applicable to reconstructive surgery.

This research has also encompassed biomaterials for tissue regeneration, with an emphasis on collagen matrices, bioactive materials and implantable surfaces, as well as modern imaging, histological, immunohistochemical and biomechanical methods for assessing regenerative processes. Together, these studies have consolidated a translational research direction aimed at developing reconstructive solutions with potential clinical applications.

In parallel, my clinical research has addressed complementary areas within hand surgery, reconstructive surgery, traumatology and surgical pathology, focusing on the critical evaluation of therapeutic strategies and their outcomes. These studies have sought to identify prognostic factors, evaluate and optimise surgical techniques, and analyse postoperative outcomes in terms of functional recovery, reduction of complications and improvement in patient quality of life.

Through this work, I have aimed to strengthen an evidence-based approach and translate research findings into improvements in surgical practice.

My interdisciplinary background, spanning anatomy, orthopaedics and traumatology, plastic surgery and reconstructive microsurgery, has fostered a particular interest in hand surgery. This field is one of the main objectives of my future professional development, which I intend to pursue by expanding my clinical and microsurgical practice, developing national and international collaborations and integrating advances in regenerative medicine into functional reconstruction.

My teaching activity has developed alongside, and in close connection with, my professional and scientific career. It began in Anatomy and Embryology and continued in Plastic and Aesthetic Surgery and Reconstructive Microsurgery. This progression has allowed me to draw on anatomical foundations in the clinical and surgical training of medical students and residents, through an educational approach centred on anatomical–clinical correlations and the progressive integration of theoretical knowledge with practical experience.

In my teaching, I have sought to integrate clinical cases and my own surgical experience into the learning process, to develop practical skills and clinical reasoning, and to use modern methods of instruction, assessment and simulation. My involvement in international academic activities has complemented this approach, allowing me to incorporate diverse educational perspectives and align my teaching with current standards and requirements in medical education. Overall, I have aimed to build a coherent educational model in which foundational knowledge, clinical experience and surgical training reinforce one another, with an emphasis on developing the professional competencies of future physicians and specialists.

From this perspective, habilitation represents the natural continuation of an academic career built on the integration of clinical practice, research and medical education. It will enable me to build on my accumulated experience through greater involvement in doctoral training, the supervision of early-career researchers and the development of interdisciplinary and multicentre scientific projects.

My plans for academic, scientific and professional development aim to consolidate an integrated direction in Plastic, Aesthetic and Reconstructive Surgery, with a particular focus on hand surgery and reconstructive microsurgery. This direction follows naturally from the career presented in this thesis and rests on the integration of clinical practice, translational research and medical education. A priority objective is to develop clinical and academic activities in these two fields, where the complexity of the conditions treated demands an interdisciplinary approach and reconstructive techniques tailored to each case. I intend to further evaluate and optimise therapeutic strategies for complex upper-limb injuries, peripheral nerve disorders and tissue defects requiring microsurgical reconstruction, with the aim of improving functional outcomes and patient quality of life.

Regenerative medicine and tissue engineering will remain a major area of development, through continued research into biomaterials, matrices, stem cells and biological strategies for tissue regeneration. In particular, I intend to further investigate peripheral nerve regeneration by developing and evaluating new nerve guidance conduits, including 3D-printed devices combined with stem cells, biological factors or other regenerative strategies. The long-term

objective is to develop experimental models with greater translational relevance and to identify solutions that can progressively move from preclinical research into reconstructive practice.

Building on this experience, I intend to develop interdisciplinary research projects in collaboration with specialists in plastic and reconstructive surgery, anatomy, orthopaedics and traumatology, biomedical engineering, cell and molecular biology, imaging and biomaterials science. I consider such a multidisciplinary approach essential for developing innovative solutions in regenerative medicine and reconstructive surgery, and a sound foundation for competitive projects at national and international levels.

Another priority is to expand multicentre and international collaborations in both experimental and clinical research. Shared databases, standardised assessment protocols and larger patient cohorts will yield findings of greater scientific and clinical value and facilitate prospective, comparative studies with higher levels of evidence.

I will also seek to increase the visibility and competitiveness of my research by participating in national and international grant competitions, developing institutional partnerships and joining research networks relevant to my areas of interest. I intend to disseminate the results through publications in prominent international journals and presentations at scientific meetings and, where the nature of the research permits, to develop solutions with potential for translation into medical practice.

An essential component of my future academic development is the training and mentoring of medical students, residents, doctoral students and early-career researchers. Habilitation will provide a framework for greater involvement in doctoral supervision and for gradually building a research team capable of developing its own projects in reconstructive surgery and regenerative medicine. I intend to encourage students and residents to engage in scientific work early in their training, to develop critical thinking and a sound knowledge of research methodology, and to gain the ability to formulate and test scientific hypotheses independently.

In education, I will continue to develop a training model that integrates anatomical knowledge, clinical reasoning, practical training and research. Expanding simulation-based methods, using digital and 3D technologies and developing practical activities dedicated to reconstructive and microsurgical techniques will be important tools in training future specialists.

In the medium and long term, my objective is to build a coherent and sustainable academic direction in reconstructive surgery, in which clinical practice generates relevant research questions, experimental and clinical research provides solutions with translational potential, and the resulting findings are integrated into education. In this way, I aim to consolidate an academic model founded on the interdependence of surgical practice, translational research and the training of future physicians and researchers, and to establish a school of research and training in reconstructive surgery, hand surgery, microsurgery and regenerative medicine.

Ultimately, by integrating these directions, I aim to pursue a coherent academic career in which research, clinical practice and medical education complement one another in advancing plastic and reconstructive surgery and training a new generation of specialists.