



# New Technology Frontiers in Minimally Invasive Therapies

Sergio Casciaro  
Borut Gersak  
Editors



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## PREFACE

The 2007 *ARISER Summer School text book* delineates the main features of future surgeries. Indeed, Novel Technologies, Molecular Imaging, Real Time Image Processing, Natural Orifices Surgery, Bio-genomics are concepts which open up new scenarios for surgery, making Minimally Invasive Therapies (*MIT*) the possible surgery of 21<sup>st</sup> century.

*MIT* brought about several advantages, among which we can easily mention a short post-operative in-hospital stay, safer procedures, faster recovery, less traumatic return to normal activities; last but not least, less and smaller scars on the body.

However, in order to have *MIT* widespread and optimally implemented, many challenges still exist, mainly referred to the learning curves of new *MIT* procedures and to the extreme multidisciplinary needs. The former is due both to the cultural evolution towards the perspective offered by *MIT*, which tries to be intrinsically *respectful* of human anatomy, and to limited technological developments of adequate training systems. This new approach introduces limitations to surgeons - either for tactile sensing or for visualization - that must be compensated by means of the massive use of innovative technology and integrated systems. The latter challenge is related to the actions necessary to bridge the gap not only among the different technological disciplines but also between them and the several medical specialties already available and the new emerging ones like genomics.

*ARISER* community is actively working on integrating the efforts of scientists and experts in different fields (such as medical imaging and processing, visualization and display, augmented and virtual reality, haptic interfaces and robotics) with several medical specialists and surgeons. The contribution of biomedical companies and manufacturers will be, undoubtedly, essential to the success of *MIT* technology systems; in fact, private industrial and trading partners are already present in the consortium and all this may represent an ideal blend of academic, research and industrial institutions.

The third edition of the *ARISER European Summer School* has been a tangible example of this effort, being a unique international event open to young researchers, experienced scientists and professors of many different disciplines coming from all around the world. A lot of happy energy and enthusiasm have been put in getting the participation of worldwide scientists recognised in the field, as well as surgeons pioneering in minimally invasive therapies.

Beside, important topics linked to *MIT* biomedical research field like bioethics, ergonomics, human interfaces, communication in science and the “Art” of scientific speaking and presenting are covered too in this book.

*MIT* results a major step up in interventional therapy, capable to offer quality of life to patients and less costs to the healthcare systems, which represent the two pillars and the future in modern medicine.

Thanks to the author' efforts and the editorial committee, this book reports extensively on the state-of-the-art and original research contributions in the field of *MIT of keynote and invited lecturers as well as ARISER speakers*.

We sincerely thank all Lecturers, Partners, Speakers, Participants, Attendees and Editors for their precious contributions, hard works and enthusiasm that made this book possible and fruitful for all.

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## New Technology Frontiers in Minimally Invasive Therapies

ARIS\*ER is a European Multidisciplinary Research Training Network funded by the European Union and created to support the technological and medical research needed for the advancement of Minimally Invasive Therapies. This new approach to therapy is a worldwide leading trend and it is opening up new scenarios in future surgical practices. One of the main purposes of the consortium is the creation of a multidisciplinary research community capable of scientifically managing a cross-disciplinary and multi-speciality area. This results to be of key importance in the perspective of educating new researchers with an international profile and competent in the understanding of the cross-cutting issues involved in the creation of new platforms for Minimally Invasive Therapy. The key features for these future technology systems are Automation, Super-Vision and Super-Sensing, enabling compensation for the limited sensorial feedbacks of surgeons when performing those therapies.

The ultimate challenge of the ARIS\*ER research community is "bridging" the numerous disciplines and specialities involved in this field by doing research and training in a unique creative mixing of research, academic, clinical and industrial partners.

Multimodal imaging techniques, real time image processing, video and visual endoscopy, robotics, haptics, augmented and virtual reality, advanced training systems and interfaces are all meant to be embedded in a novel decision support platform, capable of guiding surgeons in several intervention procedures. Various surgical specialties are also described in detail in order to explicit their specific needs.

In this yearly edition of the book, the consortium presents the advances in its research and development activities in combination with the scientific contributions of internationally recognised professors and outstanding scientists of the field, containing front end results of both theoretical and practical aspects of their work.

### **NEW TECHNOLOGY FRONTIERS IN MINIMALLY INVASIVE THERAPIES**

This book is addressed to medical doctors, technology specialists, engineers, research scientists and students interested in the multi-disciplines of Minimally Invasive Therapies. Some of the topics covered are:

- Advanced imaging diagnostic protocols and Natural Orifices Surgery (NOS).
- Bio-genomics tailoring of surgical interventions.
- Ultrasound Elastography, Molecular Imaging and Optical Coherence Tomography.
- Multi-modal real-time segmentation and registration.
- Advanced Non-Linear Resonance Interaction for non invasive cancer detection.
- Virtual and augmented reality and intra-operative visualisation and planning.
- Adaptive robotics and haptics and their use in operating and training rooms.
- MRI Compatibility Assessment and Mechatronic Devices.
- Ergonomics, cognitive engineering and intuitive interfaces.
- Bioethics and Communications in Science.

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