

# Curriculum Vitae et Studiorum

## Arianna Menciassi

October 2016

### 1. Personal Information

Name and Surname: Arianna Menciassi

Birthdate: 23/04/1971

Born in: Pisa –Italy

Citizenship: Italian

Sex: Female

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URL: <http://www.santannapisa.it/it/arianna-menciassi>



<http://www.santannapisa.it/en/institute/biorobotics/surgical-robotics-and-allied-technologies-area>

### 2. Short CV presentation

Arianna Menciassi obtained the M.Sc. in Physics from the University of Pisa in 1995 (magna cum Laude) and the Ph.D. in Bioengineering from the Scuola Superiore Sant’Anna (SSSA) in 1999. In the year 2000 she started her academic career at the SSSA with an untenured position of Assistant Professor of Biomedical Robotics and she became Associate Professor of Industrial Bioengineering in 2006 and Full Professor in May 2014, in the same institution. Currently, she is with The BioRobotics Institute of the SSSA where she is Area Leader of “Surgical Robotics and Allied Technologies”.

Prof. Menciassi teaches regularly at the Scuola Superiore Sant’Anna (courses for undergraduated students of Medicine and Engineering) and at the Pisa University (Master Degree in Biomedical Engineering, International Master Degree in Bionics Engineering). She carries on an intense research and training activity at high level (master candidates in biomedical engineering, PhD students, etc.). She is normally tutor of more than 15 students.

From April 2013 she is Vice-Dean of the “Classe di Scienze Sperimentali” of SSSA.

From Sept. 1 2013 to Feb. 1 2014 she spent one month as Visiting Professor at the Ecole Nationale Supérieure de Mécaniques et des Microtechniques (ENSMM) of Besançon (France), in the FEMTO Institute. From July to December 2014 she spent one month as Visiting Professor at the Université Pierre Marie Curie in Paris, France.

Her main research interests involve biomedical robotics, microsystem technology, nanotechnology and micromechatronics, with a special attention to the synergy between

robot-assisted therapy and micro/nanotechnology-related solutions. She carries on an important activity of scientific management of several projects, European and extra-European, thus implying many collaborations abroad. She is co-author of more than 320 scientific publications (from SCOPUS database: 186 journal papers, 135 conference papers, 14 review papers - more than 150 papers published on ISI journals) and 6 book chapters on biomedical robots/devices and microtechnology. She is also inventor of 35 patents, national and international.

She served until August 2103 in the Editorial Board of the IEEE-ASME Trans. on Mechatronics and she is now Topic Editor in Medical Robotics of the International Journal of Advanced Robotic Systems; she is Co-Chair of the IEEE-RAS Technical Committee on Surgical Robotics. She is involved in the BioRobotics Technical Committee of IEEE-EMBC. She is NTC (Nanotechnology Technical Committee) representative in the steering committee of the IEEE Transactions on Nanobioscience. She is IEEE Senior Member.

In the year 2007, she received the Well-tech Award (Milan, Italy) for her researches on endoscopic capsules, and she was awarded by the Tuscany Region with the Gonfalone D'Argento, as one of the best 10 young talents of the region.

From the year 2007, she has been collaborating with the Italian Institute of Technology in Genova, and from April 2010 she is affiliated member of the Center for MicroBioRobotics of IIT@SSSA (<http://mbr.iit.it/>).

### 3. Education and training

Institution and Location	Degree	Year	Field of Study
University of Pisa, Pisa, Italy	M.Sc. (Laurea Degree)	1995	Physics
Scuola Superiore Sant'Anna, (SSSA), Pisa, Italy	Ph.D.	1999	Bioengineering
Scuola Superiore Sant'Anna, (SSSA), Pisa, Italy	Post-Doc	2000	Biomedical Robotics

### 4. Research and professional experience

#### Positions and employment

May 2014 - present:

**Full Professor** of Industrial Bioengineering

July 2014 – Dec. 2014:

**Visiting Professor** at the Université Pierre Marie Curie, Paris, France.

2011 - present:

**Area Leader** of the “Surgical Robotics and Allied Technologies” area at The BioRobotics Institute of SSSA

Sept. 2013 – Feb. 2014:

**Visiting Professor** at the Ecole Nationale Supérieure de Mécaniques et des Microtechniques (ENSMM) of Besançon (France), in the FEMTO Institute

2009 - present:

**Affiliated member** to the Italian Institute of Technologies (IIT, Italy), for researches related to MicroBioRobotics

2009 - present:

**Associate Professor** of Biomedical Robotics (SSSA) – confirmed and permanent status

2006 - present:

**Temporary Professor** of Biomechatronics at the Pisa University

2006 - 2009:

**Associate Professor** of Biomedical Robotics (SSSA) – status to be confirmed

2001 - 2006:

**Assistant Professor** of Bioengineering (SSSA) – temporary position

### **Other Experiences, Professional Memberships and Services**

2015 – present:

**Member of GEVo9 for ANVUR VQR**, that is national agency for evaluation of quality of research centers and universities in Italy

2015 – present:

**Member of the Editorial Board for the Journal of Medical Robotics Research** (<http://www.worldscientific.com/page/jmrr/editorial-board>)

2013 – present:

**MIUR (Ministry of Education) Member** of the Steering Board of the Italian Institute of Biostructures and Biosystems

2013 – present:

**Topic Editor** of the **International Journal of Advanced Robotic Systems** ([http://www.intechopen.com/journals/international\\_journal\\_of\\_advanced\\_robotic\\_systems](http://www.intechopen.com/journals/international_journal_of_advanced_robotic_systems))

2012 – present:

**Member of the Editorial Board for the Soft Robotics journal** (<http://www.liebertpub.com/overview/soft-robotics/616/>)

2012 – present:

**Associate Editor** of the Journal of Micro Bio-Robotics (Springer)

2011 – present:

**Co-Chair** of the IEEE RAS Technical Committee in Surgical Robotics

2010 – present:

**Member of the Board of the Bioengineering National Group** (Giunta del Gruppo Nazionale di Bioingegneria)

2009 – 2013:

**Associate Editor** of the IEEE/ASME Trans. on Mechatronics

2008 – present:

**Member of the IEEE RAS Technical Committee** in Micro/Nano Robotics and Automation

2008 – 2010:

**Editorial Assistant** of the Journal of Micro Mechatronics (Springer)

2007 – present:

**Program Committee Member**, Special Sessions and Workshops organizer for several conferences in Robotics and Biomedical Engineering (ICRA, IROS, EMBC, BioRob, IPCAI)

2006 – present:

**Guest Editor** of Special Issues and Focused Sections for: the IEEE-ASME Trans. on Mechatronics (with Paolo Dario in 2007, with Metin Sitti, Auke Ijspeert, Kin Haul Low, Sangbae Kim, Xinyan Deng in 2011-2012), the IEEE Trans. on Biomedical Engineering (with Jaydev Desai and Auke Ijspeert in 2008-2009), Biomedical Microdevices (with Leonardo Ricotti and Keisuke Morishima in 2012).

2004 – present:

**Member** (with different roles) of the SMIT Society (Society for Medical Innovation and Technology)

2001 – present:

**IEEE RAS and EMBS Member**

## 5. Honors and awards

This section reports all main awards (and few nominations) which were assigned directly to Arianna Menciassi (especially at the beginning of her career) and also to Master and PhD students under the tutorship of the candidate (e.g. in the case of Ph.D. thesis awards).

2015:

- The FUTURA project coordinated by A. Menciassi has been awarded with the TECHNOLOGY AWARD @ SMIT 2015 conference - <http://www.smit2015.com/>, Brno, Sept. 2016

- The FUTURA project coordinated by A. Menciassi has been awarded with the Best Abstract Prize @ EUFUS 2015 conference - <http://eufus.org/>, London, Oct. 2016

2014:

- **European Biomaterials and Tissue Engineering Doctoral Award**. This award has been assigned to Dr. Ricotti, for activities performed during his PhD course under the supervision of A. Menciassi - European Biomaterials Society (ESB) Conference – Liverpool (UK) – 31 Aug. – 3 Sept. 2014

2013:

- **Finalist for the ICROS Award for the Best Application Paper**, “Stiff-Flop surgical manipulator: mechanical design and experimental characterization of the single module”, by M. Cianchetti, T. Ranzani, G. Gerboni, I. De Falco, C. Laschi, A. Menciassi, IROS 2013, International Robotics Symposium, Tokyo (Japan), Nov. 3-8, 2013.

- **Master Thesis Award** from the Italian National Bioengineering Group. Assigned to Veronica Iacovacci during the XXXII Annual School of the Italian Bioengineering Group (Gruppo Nazionale di Bioingegneria, GNB), in Bressanone (Italy). Arianna Menciassi was the supervisor of this Master thesis.
- **Best Bioengineering Ph.D. Thesis award**, ISIB-IEIIT CNR and Italian National Bioengineering Group. Assigned to Massimiliano Simi during the XXXII Annual School of the Italian Bioengineering Group (Gruppo Nazionale di Bioingegneria, GNB), in Bressanone (Italy). Arianna Menciassi was the tutor of this Ph.D. activity.
- **Best oral presentation award** at The International Conference on Biomimetic and Biohybrid systems (Living Machines 2013), London (UK), 29th July – 2nd August 2013. Title: “Three-dimensional tubular self-assembling structure for bio-hybrid actuation”. Authors: L. Ricotti, L. Vannozzi, P. Dario, A. Menciassi.
- **Best oral presentation award** at the Italian Biomaterials Society Conference (SIB 2013), affiliated with the European Society for Biomaterials (ESB), Baveno (Italy), 3rd – 5th June 2013. Title: “Engineered materials for the development of bio-hybrid actuators”. Authors: L. Ricotti, P. Dario, A. Menciassi.

2012:

- **“Massimo Grattarola” 2012 Award** for the Best Ph.D. Thesis in Bioengineering. Assigned to Leonardo Ricotti during the XXXI Annual School of the Italian Bioengineering Group (Gruppo Nazionale di Bioingegneria, GNB), in Bressanone (Italy). Arianna Menciassi was the tutor of this Ph.D. activity.
- **Master Thesis Award** from the Italian National Bioengineering Group. Assigned to Iris De Falco during the XXXI Annual School of the Italian Bioengineering Group (Gruppo Nazionale di Bioingegneria, GNB), in Bressanone (Italy). Arianna Menciassi was the supervisor of this Master thesis.
- The paper “Sviluppo di un sistema di visione per capsule endoscopiche in ambiente liquido”, by I. De Falco, G. Tortora, P. Dario, A. Menciassi, received the **Best Contribution for the Technology Transfer** at the III Conference of the Italian Bioengineering Group, Rome (Italy), June 2012.
- The abstract “Magnetic air levitation capsule: a novel approach for frictionless colonoscopy” by G. Ciuti, A. Verbeni, R. Melis, P. Dario, A. Arezzo, A. Menciassi was awarded as one of the seven **best original presentations at the EAES Technology Award Session** at the 20th International EAES Congress in Brussels (Belgium), June 2012.
- The paper “Intra operative 3D reconstruction for image-guided navigation in active capsule endoscopy” by G. Ciuti, A. Menciassi, P. Dario, M. Visentini Scarzanella, A. Dore, G.Z. Yang received the **Best Student Poster Award** at the ISCAS/CARS conference, Pisa (Italy), June 2012.
- The paper “Magnetic dragging of vascular obstructions by means of electrostatic and antibody binding” by M. Khorami, P. Dario, A. Menciassi and E. Sinibaldi has been **candidate for the best medical robotics paper award** at the IEEE Int. Conference on Robotics and Automation, St. Paul (MN), May 2012.

- **Best presenter award**, M. Simi, G. Gerboni, A. Menciassi, P. Valdastri “Magnetic Mechanism for Wireless Capsule Biopsy”, Design of Medical Devices (DMD) Conference, 10-12th April 2012, Minneapolis (MN).

2011:

- The paper “A Novel Surgical Robotic Platform Minimizing Access Trauma” by T. Ranzani, C. Di Natali, M. Simi, A. Menciassi, P. Dario, P. Valdastri receives the **Best Oral Presentation Award** at the Hamlyn Symposium on Medical Robotics (London, U.K.)
- The paper “Magnetic air capsule robotic system: a novel approach for painless colonoscopy” by P. Valdastri, G. Ciuti, A. Verbeni, A. Menciassi, P. Dario, A. Arezzo, M. Morino is awarded with the **EAES Best Technology Contribution Award** (Turin, Italy, June 2011 – European Association of Endoscopic Surgery Conference 2011)

2010:

- The VECTOR project on robotic endoscopic capsules (<http://www.vector-project.com>) receives the "**Best Exhibit Award**" at the ICT 2010 Conference in Brussels (Belgium)
- **Winner of the “Spin Your Thesis! Campaign 2010”**, promoted by the European Space Agency (ESA), with the project “Investigation of hypergravity on proliferation metabolism and differentiation of muscle cells”. Advisors: Prof. A. Menciassi and Dr. M. Monici.
- Selected as a **finalist for the program “Fly Your Thesis 2010”** promoted by ESA. The project (MuSpace2010) was within the 12 best proposals promoted by European research groups. Advisors: Prof. A. Menciassi and Dr. M. Monici.
- **“Massimo Grattarola” 2010 Award** for the Best Ph.D. Thesis in Bioengineering. Assigned to Gianni Ciofani during the 29<sup>th</sup> Annual School of the Italian Bioengineering Group (Gruppo Nazionale di Bioingegneria, GNB), in Bressanone (Italy). Arianna Menciassi was the tutor of this Ph.D. activity.

2009:

- The paper “Wireless Reconfigurable Modules for Robotic Endoluminal Surgery” by K. Harada, E. Susilo, A. Menciassi e P. Dario is **finalist for the Best Medical Robotics Paper Award** at ICRA 2009 (Kobe, Japan)
- The Springer Handbook of Robotics (where A. Menciassi is co-author of the chapter on Medical Robotics) is awarded with the **PROSE Award for Excellence in Physical Science and Mathematics Award** in the Engineering & Technology Category
- **Excellent Paper Award** from the Society of Biotechnology (Japan). Title: “Bicompartamental device for dynamic cell coculture: design. realization and preliminary results”, Journal of Bioscience and Bioengineering, vol. 105, p. 536-544, 2008. Authors: G. Ciofani, A. Migliore, V. Raffa, A. Menciassi, P. Dario

2008:

- **Best Master Thesis Award** for the thesis “Study and development of endoscopic robot with locomotion based on permanent magnetic field” assigned to Gastone Ciuti at the 8<sup>th</sup> edition of the School of the National Group of Bioengineering (Bressanone, Italy). Arianna Menciassi was the supervisor of this thesis
- The paper “Novel haptic tool and input device for bilateral biomanipulation addressing endoscopic surgery” by K. Houston, O. Tonet, C. Eder, A. Menciassi, P. Dario, A. Sieber,

receives the **Best Student Paper Award** at the International Conference BIODEVICES/BIOSTEC 2008 (Madeira, Portugal)

- The paper “A Miniaturized Wireless Control Platform for Robotic Capsular Endoscopy using Pseudokernel Approach” by E. Susilo, P. Valdastri, A. Menciassi, P. Dario receives the **Best Paper Award** at the conference Eurosensors 2008 (Dresda, Germany)

2007:

- **Gonfalone d’Argento** from the Tuscany Region (Italy) as one of the 10 top talented persons of the Tuscany Region
- **Well-Tech Award 2007** (June 2007, Milan, Italy): “Premio per l’innovazione che migliora la qualità della vita” (Innovation for improving quality of life), thanks to the activity on endoscopic capsules

2001:

- The paper “Force Feedback-based Microinstrument for Measuring Tissue Properties and Pulse in Microsurgery” by A. Menciassi, A. Eisinger, G. Scalari, C. Anticoli, M.C. Carozza, P. Dario, receives the **Best Manipulation Paper Award at ICRA 2001** (Seoul, South Korea).

## 6. Academic activities and responsibilities

Arianna Menciassi participates from 2006 to the “**Collegio dei Docenti**” of different universities. The most intense activity is that one carried out in the Framework of the Collegio dei Docenti of the “Innovative Technologies of Info. & Com. Eng. and Robotics “ PhD Program at SSSA. Such PhD course lasts 3 years and it involves almost 100 PhD students. Recently, with the organization of the Scuola Sant’Anna in different Institutes, Arianna Menciassi is also member of the “Collegio dei Docenti” for the PhD in Biorobotics promoted by The BioRobotics Institute of SSSA and enrolling at least 20 students per year.

In addition, Prof. Menciassi also participated in other “Collegi dei Docenti”, for the following PhD programs:

- “Industrial Engineering”, Università di Tor Vergata, Rome, from 2006;
- “Biomedical Engineering”, Università Campus Biomedico, Rome, from 2007;
- “Biotechnological and technical innovations applied to surgical sciences”, Università di Tor Vergata, Rome, from 2009;
- “Technologies applied to surgical sciences”, Università degli Studi di Torino, from 2011.

In addition to the already listed responsibilities, Arianna Menciassi regularly participates in **final PhD examination commissions** for several Italian and International universities (e.g. in Italy: Pisa, Trento, Torino, Milan, etc.; out of Italy: Nanyang Technological University of Singapore, Waseda University in Tokyo, University of Barcelona, EPFL in Switzerland, Strasbourg University, Montpellier University, Libre Universite de Bruxelles, etc.).

From June 2008 to March 2013, Arianna Menciassi was the **President of UJ Consortium** (Career and Placement Services), a joint initiative of SSSA, Scuola Normale and Istituto Alti Studi IMT of Lucca, aimed towards placement and orientation activities for graduated and PhD students.

From 2008 she is **Member of the Committee “Pari Opportunità”** of SSSA.

From April 2013 she is **Vice Dean for the Class of Experimental Science** of the Scuola Superiore Sant'Anna.

## 7. Teaching activity and supervision/tutoring of students

The main regular teaching activities of Arianna Menciassi are at the Scuola Superiore Sant'Anna and at the Pisa University (Master Degree in Biomedical Engineering). Regular - even if less intense - teaching activity are also performed at the University of Torino.

At SSSA, she regularly teaches the **engineering PhD course of “Micro and nano-robotics for medical applications”** (since 2006, 2 or 3 CFU). She also teaches the course of **“Introduction to Bioengineering”** for Master and PhD students of Medicine (since 2009, 1 CFU), the course **“Introduction to robotics at different scales”** for Master students of Engineering (since 2015, 1 CFU), and other hands-on course on surgical robotics.

At the Pisa University she taught the **course of “Biomechatronics”** addressed to the Master students of biomedical engineering from 2006 to 2016 (6CFU). For the same Master program of biomedical engineering she contributes to the course of **“Medical Robotics”**.

From September 2016, she teaches the M.Sc. course of **“Robotics for minimally invasive therapy”** (6 CFU) in the Master of Science in Bionics Engineering, jointly delivered by SSSA and University of Pisa.

Since the year 2011, she teaches a **course of “Nuove tecnologie in endoscopia digestiva”** (Novel technologies in digestive endoscopy) for the Master in Digestive Endoscopy of the **University of Torino** (Medicine and Surgery Department), (13 hours, 0.52 CFU).

She is regularly invited to give teaching sessions during **Summer Schools** or to contribute to **International and National Master courses**. The most relevant activities are listed below:

- II level University Master “Smart Solutions - Smart Communities”, A. Y. 2013-2014, at the Scuola Sant'Anna (sponsored by TELECOM). Arianna Menciassi taught a 12 hours module in the section “Vision, Context, Technology, Management e Case Studies”;
- IRCAD Student Lecture B.E.S.T. Innovation Course (Strasbourg, France), Editions of February 2012 and February 2013;
- PhD course of Medical Robotics, Politecnico di Milano, May 2011;
- PhD in Digestive Endoscopy at Università di Torino, October 2011;
- WASEDA-SSSA-KIST Summer Schools 2008 “Fundamentals of Biorobotics”, Volterra (Pisa), and 2010 “The emotional Human-Robot Interaction”, Seoul (South Korea), 11-15 October 2010;
- II level Master in “Design of micro and nanotechnologies for bioartificial systems” at Politecnico di Torino, A.Y. 2006-2007. Didactic module of Nano-robotics and NEMS;
- International Master in Robotics and Mechatronics, Scuola Superiore Sant'Anna, A.Y. 2006-2007. Title of the course: Micro and nano robotics for medicine.
- Summer School of Surgical Robotics, Montpellier, France, 2015 (<http://www.lirmm.fr/sssr-2015/>).

Since the beginning of her career as Associate Professor at the SSSA (May 2006), Arianna Menciassi has been **supervisor of many bachelor, master and PhD students**.



More specifically, in the last 8 years (2008-2016) she has been the supervisor of about 25 PhD Theses, 79 Master Theses and 9 Bachelor Theses.

## 8. Technology transfer activity

Arianna Menciassi is **charter member of two spin-off companies of SSSA**: MicroTech srl (now Ekymed SpA), operating in the field of biomedical microengineering, and Era Endoscopy srl, operating in the field of semi-autonomous colonoscopy, exploiting the results of several research efforts in the field of minimally invasive diagnostics. Arianna Menciassi is still member of Ekymed.

More recently (October 3, 2013), in collaboration with colleagues from SSSA and Torino University, she won the **second prize** (€ 15.000) at the **IX edition of START CUP Piemonte Valle D'Aosta 2013** (Settore BIO e MEDICALE) for the RED project (<http://www.i3p.it/start-cup-I-vincitori>). The project is about the design and development of an innovative colonoscope for endosurgery.

Arianna Menciassi carried out several **projects for research exploitation**, both locally and at European and international level. An example is the IHKI project, funded from 2004 to 2006 by MAP-ICE (Ministero Attività Produttive / Ministero per il Commercio Estero). Such project, under Arianna Menciassi's scientific responsibility, consisted on carrying out training courses and meetings targeted at promoting joint industrial activities Italy – Hong Kong, in the field of medical microengineering.

From June 2008, Arianna Menciassi is **member of the evaluation committee of the company incubator CERFITT** (Centro di Ricerca e Formazione sull'Innovazione ed il Trasferimento Tecnologico), at Polo Tecnologico Pont-Tech (Pontedera).

From January 2012, Arianna Menciassi is **member of the Scientific Committee of Polo d'Innovazione della Regione Toscana ICT Telecomunicazioni Robotica (POLITER)**.

Arianna Menciassi is inventor of **35 national and international patents**, of which: 8 patents have been granted, 5 patents have been abandoned, 1 patent is in co-ownership between Scuola Superiore Sant'Anna and the Vanderbilt University and 2 patents are in co-ownership between Scuola Superiore Sant'Anna and the Italian Institute of Technology. For 2 patents there are on-going exploiting agreements with a Korean corporation and with a German biomedical company. For 4 patents the national phases have been opened: they represent patents with a high potential industrial interest, which could lead soon towards commercial exploitation agreements.

## 9. Track record and details

In the **Scopus database**, the **total number of publications** by Arianna Menciassi from the beginning of her career is **365**.

Based on the above publications, these are the main figures that can be derived:

Citation number: **5698**

H-index: **40**

## **10. Presentation of scientific publications and research activity**

From the beginning of the PhD in 1996 to now, Arianna Menciassi has been approaching the design of miniature and micro-machines for biomedical applications, paying attention to the interaction between artificial devices and biological tissues in the micro scale. In this framework, she approached not only the study and development of methodologies, devices and robotic components for minimally invasive therapy and surgery, but also the investigation of nanotechnology-based solutions for improving the interface between cells and artificial substrates for drug-delivery problems or for the development of bio-artificial systems.

One of the main features of her scientific production is the interdisciplinary approach. Starting from a Physics background, Prof. Menciassi gradually acquired methods and tools of engineering, but she continued to pay attention to all innovations coming from applied sciences and life sciences. In addition, at the Scuola Superiore Sant'Anna, she had the chance to investigate problems related to acceptability and sustainability of biomedical technologies, thus making an accurate evaluation of the research activities in bioengineering not only from the technical viewpoint but also on the socio-economic viewpoint.

At the beginning of her career, Arianna Menciassi approached problems of microsystem technologies for developing innovative solutions for biological microparticle micromanipulation. More specifically, she investigated sensorization issues for manipulation microtools and she approached topics related to how giving a feedback to the operator during manipulation. The strong competence acquired in the field of micromachining and microfabrication allowed Prof. Menciassi to provide a continuous contribution to microactuation and hybrid microtechnologies for fabricating biorobotic components.

Starting from this expertise, Prof. Menciassi continued the investigation of methodologies for mechanical properties characterization of bio-tissues. She studied the interaction between microtools for characterization and micro-samples and she derived theoretical models for the palpation problem and a quantitative analysis of the forces when object size scales down. Thanks to this research activity, she was awarded by the Best Manipulation Paper Award at the ICRA 2001 Conference in Seoul (South Korea). In these mechanical characterization activities, Prof. Menciassi always considered in depth interface issues with the user, in order to provide no trained operators with an evaluation tool for estimating the pathologic level of tissues in surgery and diagnostic processes.

This specific aspect of her activity explains the transition from micromanipulation of biological tissues to wider problems related to minimally invasive therapy and surgery. In fact, a large part of her scientific production approaches the study and development of robotic systems for microendoscopy, with a peculiar attention to gastrointestinal (GI) endoscopy and treatment. In the period 2000-2003, Prof. Menciassi approached the problem of semiautonomous locomotion in the GI tract, starting from the mechanical and tribological characterization of the intestinal environment. This methodology allowed her to understand typical phenomena related to locomotion in tubular, compliant and not structured environments, and to go forward with the design of efficient mechanisms for propulsion and adhesion onto the GI cavities. This research activity led to the invention of a bio-inspired semiautonomous colonoscopic device, that is currently produced by a start up company of the Scuola Sant'Anna and it has been tested in several pilot studies on humans.

The bioinspired approach, which led to the development and optimization of colonoscopic devices, also drove further research activities of Arianna Menciassi between 2002 and 2006. In fact, a notable part of her scientific production concerns topics related to biomimetics and biorobotics. Understanding mechanic and perception functions of lower animal species is fundamental to improve traditional actuation and sensing systems, and it generates important follow-ups in minimally invasive surgery and diagnosis.

In the same period, Arianna Menciassi started a large project funded by the Intelligent Microsystem Center (Seoul, South Korea) which ended in the year 2010 and which allowed her to enlarge her research activity by developing endoscopic wireless capsules. This research activity generated a large scientific production on different topics related to endoscopic capsules: e.g. on the study and development of autonomous and teleoperated locomotion systems; on the development, integration and test of cameras and illumination systems; on the development of microsystems for therapy and advanced diagnosis to be integrated on board endoscopic capsules, etc.

Since the year 2006, by exploiting the competences acquired in the field of wireless endoscopy, and by taking advantages of the trend of minimally invasive surgery addressing more and more solutions based on endoluminal and single access surgery, Arianna Menciassi have been exploring the research area of surgical robotics. Her original contribution in this field concerns the exploitation of external forces (e.g. magnetic fields) for the generation of propulsion forces inside the human body and the combination of more miniaturized systems (e.g. several single capsules) for the development of endoluminal surgical platforms with advanced kinematics.

In the last 3-5 years, Prof. Menciassi has strengthened her interdisciplinary collaboration with endoscopists and surgeons. Thanks to the development of endoscopes and tiny but reliable surgical tools, she also produced papers targeted to the medical community, with an insight on the applicability of new technologies and on the validation of the developed novel instrumentation. This approach allowed Arianna Menciassi to make the medical community aware about the potentials of micro-robotics and about still unsolved problems related to micro-robotics take up.

By combining the research of minimally invasive bioengineering solutions for therapy and diagnosis and the original competence on Physics, Arianna Menciassi has been also investigating nanotechnological approaches for diagnosis and therapy, more and more localized and accurate. More specifically, she studied nanoparticles and nanofibres as possible smart and teleoperated vectors for diagnostics and intervention. The final objective of this activity is to merge medical robotics competence and technologies with the potentials offered by nanotechnologies. The concept of robotic control - that is typical of traditional surgical robots - should be moved also to the miniature therapy, by using "on-board" control or also external control means (e.g. exploiting magnetic fields or ultrasound for the propulsion and imaging control of microdevices).

In the last three years, by blending the know-how in surgical robotics with the know-how in bio- and nano-technologies, Arianna Menciassi has been approaching problems of navigation, control, therapy and diagnosis in the cardiovascular system. The cardiovascular system, with its peculiarities in terms of typical forces, sizes, difficulties in control and visualization, can be considered the elective arena where demonstrating the potentials of the synergy between surgical robotics and nanotechnology approaches.

## 11. Role within funded Research Projects

Project	Duration (months)	Role
M2Neural (Multifunctional Materials for Advanced Neural Interfaces), M-ERA.NET Transnational framework (FP7)	36 active	Project Coordinator
SUAVES (Artificial Urinary System based on bladder and sphincter endoprotheses), Lucca Bank Foundation	24 active	Project Coordinator
FP7-ICT-2013: FUTURA - Focused Ultrasound Therapy Using Robotic Approaches	36 active	Project Coordinator
FP7-ICT-2011-7: STIFF-FLOP: STIFFness controllable Flexible and Learn-able manipulator for surgical Operations	48	Scientific responsible for SSSA
FP7-SME-2012: SUPCAM - New cost effective and minimally invasive endoscopic device able to investigate the colonic mucosa, ensuring a high level of navigation accuracy and enhanced diagnostic capabilities	24	Scientific responsible for SSSA
Intuitive Surgical, Inc - Research Grant: 2013 Awards Program - SACTIONPOL - Safe retrACTION based on magnetic forces and POLYmeric films	12	Project Coordinator
SSSA Grant – Get Small: TarGeted Therapy at Small scales	12	Project Coordinator
Fondazione Cassa di Risparmi di Pisa. 2010-2013. MicroVAST – Microsystems for vascular diagnostics and intervention. (Arianna Menciassi is co-PI and she coordinates the research activities of SSSA, aimed at developing a navigation/tracking system for vascular probes, for the removal of vulnerable plaques in large and small vessels)	42	Technical Project Manager
MILORDS – Regione Toscana (Arianna Menciassi is co-PI for SSSA and she coordinates the research activities aimed at developing a sensorised tool for prostate therapy and an ophthalmologic robot)	42	Technical Project Manager for SSSA

FP7-ICT-2009-4: SCath - Smart Catheterization	36	Scientific responsible for SSSA
Intelligent Microsystem Center, Seoul, South Korea. 2000-2010. EMIL, EMILOC and OPTIMUS projects. (Arianna Menciassi coordinated a group aimed at developing teleoperated locomotion strategies for robotic capsules, for an overall duration of 10 years)	120	Technical Project Manager
Cassa di Risparmio di Pisa Foundation. MicroSURF: Micro-Strumentazione per Chirurgia Fetale (Micro-instrumentation for fetal surgery). (Arianna Menciassi coordinated a group aimed at developing miniaturized instruments for fetal surgery applications)	36	Technical Project Manager
Italian Institute of Technologies. IIT Network Biorobotic Center (Multidisciplinary Research Network of the Italian Institute of Technologies). 2006-2009. (Arianna Menciassi coordinated a group of PhD students working on nanoparticle-mediated drug delivery, cell adhesion on nanostructured substrates and external magnetic guidance of drugs for advanced therapies)	36	Technical Project Manager
EU-IST-STREP. 2006-2009. ARES - Assembling Reconfigurable Endoluminal Surgical system. (Arianna Menciassi collaborated with the project Coordinator in the development of a reconfigurable robotic system for “internal” scarless surgery)	36	Technical Project Manager
EU-NMP-STREP. 2006-2009. NINIVE - Non Invasive Nanotransducer for in vivo gene therapy. (Arianna Menciassi collaborated with the project Coordinator in integrating medical-surgical aspects with nanotechnology related issues)	36	Technical Project Manager
EU-IST-IP. 2006-2011. VECTOR - Versatile Endoscopic Capsule for gastrointestinal Tumor Recognition and Therapy. (Arianna Menciassi managed the technical coordination of the project, with special attention to the development of technologies able to be integrated in teleoperated robotic capsules and to the development of advanced devices for endoscopy)	48	Technical Project Manager
EU-IST-IP. 2008-2012. ARAKNES - Array of Robots Augmenting the KiNematics of Endoluminal Surgery. (Arianna Menciassi was co-PI and she was involved in	48	Technical Project Manager

the development of a bimanual robotic platform for single-port access surgery)		
EU-IST-IP. 2004-2008. I-SWARM - Intelligent Small World Autonomous Robots for Micro Manipulation. (Arianna Menciassi coordinated for more than two years a group of PhD students, working on the development of microsystem technologies for robot fabrication and assembly)	48	Technical Project Manager for SSSA
EU Marie Curie. 2004-2007. ASSEMIC - Advanced Methods and Tools for Handling and Assembly in Microtechnology. (Arianna Menciassi was the representative of SSSA for the education of European PhD students funded by Marie Curie fellowships, in the field of robotic micromanipulation)	36	Technical Project Manager

## 12. Invited lectures and Conference organization

### Main invited lectures

#### 2016:

- Robotic technologies, micro-technologies and targeted therapy: challenges and opportunities, Max Planck Institute Stuttgart (Germany), January 2016.
- Robots for minimally invasive surgery: the importance of targeting, IEEE Life Science Grand Challenges Conference, Abu Dhabi (UAE), January 2016.

#### 2015:

- Endovascular Softly Tethered Probes with US Tracking and Therapeutic Features, Hamlyn Symposium, June 2015, London, UK.
- Bio-Inspired Robots, The European Association of Endoscopic Surgery, Bucharest, June 2015.
- A computer-assisted robotic platform for high-intensity focused ultrasound surgery: the FUTURA project, SMIT Conference, Brno, September 2015

#### 2014:

- Advanced Materials and Systems for Biohybrid Actuators and Sensors. Beijing Institute of Technology (BIT), Beijing on May 30, 2014. Workshop on Hybrid Fusion of Robot-Human Bio-functions toward Cyborg.
- Sensori per organi interni. XXXIII Annual School of Bioengineering, Bressanone, Sept. 16-20, Italy.

#### 2013:

- Merging Robotics and Nanotechnologies for Advancing Digestive Endoscopy. X Congresso Nazionale Società Italiana di Endoscopia ISSE & Second Meeting International Society for Surgical Endoscopy. Verona, May 31, Italy.

- Endoluminal Interventions and Microrobotics. The Hamlyn Symposium on Medical Robotics. London, June 22-25, U.K.
- Attuatori bio-ibridi. XXXII Annual School of Bioengineering, Bressanone, Sept. 16-20, Italy.
- New Generation Robots for Endoluminal and Single Access Surgery. Design of Medical Devices Conference, Europe Edition 2013. Delft, Oct. 9, The Netherlands.
- Robotics for the narrowest districts of the human body. King's College London Department of Informatics Research Colloquium Series, Dec. 4, U.K.

2012:

- Robots for single port surgery. EAES (European Association of Endoscopic Surgery) International Congress, Brussels, Belgium.
- Surgical Robotics: achievements and challenges. Symposium on Artificial Organs, Biorobotics, and Rehabilitation Engineering, Beirut, Lebanon.

2011:

- MicroRobotic technologies for surgery and endoscopy. IX Thematic workshop about "Advanced multimodality endoscopic instruments in the Detection, Diagnosis, Therapy and follow-up of diseases", Marseille, France.
- Minirobots in surgery. XVII Congreso SEIQ, Oviedo, Spain.

2010:

- Future Trends in Surgical Robotics. Journées du GDR Robotique, CNRS- Paris, France.
- From Miniature to Micro Robots for Diagnostic and Therapeutic Applications. Chonnam University, South Korea.

2009:

- Contribution of Micro/Nanosystem Technologies in the Evolution of Therapy and Surgery. Waseda GCOE International Symposium on "Practical Chemical Wisdom", Tokyo, Japan.
- Nanosystems technologies for therapy and surgery. Seoul National University, South Korea.
- Frontiers of Robotics in Surgery: single and multiple robotic capsules for endoluminal surgery. 44<sup>th</sup> Congress of the European Society for Surgical Research, Nimes (France).

2008:

- Present and Future of the Pill Endoscopy. 1st VECTOR Dissemination Event, Roma, Italy.
- Frontiers of Robotics Technologies in Endoluminal Surgery. 16th International Congress of the European Association of Endoscopic Surgery, Stockholm, Sweden.
- A visionary approach to endoluminal robotics. 20th International Conference of Society for Medical Innovation and Technology, Vienna, Austria.
- Microrobots: il futuro della chirurgia?. La medicina incontra la realtà virtuale, Roma.
- Microrobots for medical applications as a common challenge in Europe and South Korea: some case studies. EU-Korea Cooperation Forum on ICT Research, Brussels, Belgium.

2007:

- Robotica e chirurgia (Robotics and surgery). Pianeta Galileo 2007. La Toscana incontra la scienza.

2006:

- Micro & Nano Robots in the Biomedical Field. Nanomedicina: ricerca ed alta formazione, Milano.
- Robot Systems for GI Endoscopy. Convegno della Telemedicina e dell'Informatica Medica, Vicenza.
- Microrobotic Technologies in Endoluminal Applications. IARP-IEEE/RAS-EURON Joint Workshop on Micro and Nano Robotics, Paris, France.

### **Participation to Conference organization**

From 2007, Arianna Menciassi is Program Committee Member, organizer of Special Sessions and Workshops for several Conferences on Robotics and Biomedical Engineering (ICRA – International Conference on Robotics and Automation, IROS – Intelligent Robots and Systems, EMBC – Engineering in Medicine and Biology Conference, BioRob – International Conference on Biomedical Robotics and Biomechanics, Congresso Italiano di Bioingegneria, etc.).

Arianna Menciassi is in the CEB (Conference Editorial Board) of ICRA 2016.

She is co-chair of the CRAS 2016 workshop (September 2016, Pisa, Italy - <https://www.cras-eu.org/Database/news/cras-2016-pisa>).

## **13. Referee appointments**

Arianna Menciassi regularly carries out revision activities for several international journals, as follows:

- IEEE/ASME Trans. on Mechatronics;
- IEEE Trans. on Robotics;
- IEEE Trans. on Biomedical Engineering;
- Sensors and Actuators A, Elsevier;
- Sensors and Actuators B, Elsevier;
- International Journal of Robotics Research, SAGE Journals;
- Smart Materials and Structures, IOP;
- J. of Micromech. Microeng., IOP;
- MITAT Minimally Invasive Therapy & Allied Technologies, Taylor & Francis Group;
- Robotica, Cambridge Journals;
- Technology and Health Care, IOS Press;
- International Journal of Robotics and Automation, ACTA Press;
- Applied Surface Science, Elsevier;
- Mechatronics, Elsevier;
- Applied Bionics and Biomechanics, IOS Press;
- Biomedical Microdevices, Springer.



- PLoS ONE.

Arianna Menciassi also carries out revision activities for the most important conferences on robotics and bioengineering, such as:

- International Conference on Robotics and Automation (ICRA);
- International Conference on Intelligent Robots and Systems (IROS);
- Annual Conference of the Engineering in Medicine and Biology Society (EMBC).

Furthermore, she also carries out revision activities for several funding agencies, such as:

- National Natural Science Foundation of China (NSFC);
- MRC National Medical Research Council of Singapore;
- Swiss National Science Foundation;
- European Commission (revision of an ERC Advanced Grant).