Personal information Laura Caramazza

EDUCATION AND TRAINING

November 2018-Present

PhD student in Information and Communications Technologies (ICT) XXXIV Cycle

University of Rome "Sapienza", Department of Information Engineering, Electronics and Telecommunications (DIET), Division of Electronic Engineer, Rome, Italy.

Supported by Center for Life Nano Science@Sapienza, Istituto Italiano di Tecnologia (IIT), Rome, Italy

Research topic: Study and design of drug delivery systems activated by electric and magnetic fields application: theoretical and experimental approach.

Supervisor: Prof. Francesca Apollonio, francesca.apollonio@uniroma1.it.

September 2015 – July 2018

Master of Science in Nanotechnology Engineering

Sapienza University of Rome, Rome, Italy

Title of the thesis: Stimuli-responsive liposomes activated by nanosecond pulsed electric field: an integrated approach

Grade 110 out of 110, cum laude

February - July 2018

Trainee for Master degree achievement in Nanotechnology Engineering

at the Department of Information Engineering, Electronics and Telecommunications (DIET) and in collaboration with the Department of Drug Chemistry and Technologies, University of Rome "Sapienza": numerical and experimental study of nanosecond pulsed electric fields (nsPEF) application on nanometre sized phospholipid vesicles, called liposomes, including the characterization of the entire bench and the analysis of microscope images.

Skills gained:

- Ability to use the numerical simulation software COMSOL and HFSS for modelling complex systems.
- Ability to properly analyze and comment simulation results.
- Experience with numerical processing of signals applied on image signals from microscopy.
- Well assessed knowledge of nsPEF application on nanometre sized liposomes and defining experimental protocol.

August 2015

Full-time English course

EF International Language Centers, Boston MA, United States

- Intercultural communication skills

September 2011 – July 2015

Bachelor of Science in Chemical Engineering

Sapienza University of Rome, Rome, Italy
Title of the thesis: Multistage extraction of lycopene from tomatoes waste
Grade 99 out of 110

May – July 2015

Trainee for Bachelor degree achievement in Chemical Engineering

at the Department of Chemical Materials, Environmental Engineering (DICMA), Rome, Italy
Skills gained:

- Good knowledge of multistage extraction process of active biomolecules;
- Ability to use laboratory glassware, spectrophotometer, water bath and precision balance devices (all experimental data were analyzed plotted with the software "Excel").

September 2006-July 2011

High school leaving qualification in scientific studies

"Isacco Newton", Rome, Italy, Subjects including Math's, Science, Chemistry, English
Grade 100 out of 100

RESEARCH ACTIVITY

14 - 19 April 2019

COST Action [CA17115] MyWave STSM

Participation to the short-term mission as involved person.

Title: "Magnetoliposomes for hyperthermia based clinical approach and remotely controlled drug delivery", Home Institution: Sapienza University of Rome, Italy;

Host Institution: Aristotle University of Thessaloniki, Greece

December 2019 – today

Progetto di Ricerca di Ateneo: RM11916B835D12D4
Participation as PhD Student.

Title: "Liposome vesicles loading magnetic nanoparticles as optimal drug delivery nanosystems controlled by magnetic fields".

In collaboration with the Department of Chemistry and Pharmaceutical Technologies, Sapienza University of Rome, Italy.

December 2020 - today

Progetto di Ricerca di Ateneo: RM120172B6F1B0D6
Participation as PhD Student.

Title: "Optimization of magnetic field remote controlled lipid vesicle nanocarriers".

In collaboration with the Department of Chemistry and Pharmaceutical Technologies, Sapienza University of Rome, Italy.

21 – 24 January 2020

Collaboration with the Department of Chemical Sciences, University of Padova, Italy

Title: "Time-Domain NMR analysis of nano-sized liposome exposed to ultra-short pulsed electric fields"

15 February – 18 March 2020

COST Action [CA15211] ElectroNET STSM

Grant winner for the short-term mission

Title: "Investigations on driving mechanisms of lipid vesicles destabilization due to intense electric fields with characteristics of the lightning"

Home Institution: Sapienza University of Rome, Italy

Host Institution: CNRS - University of Paris-Saclay - Gustave Roussy UMR 9018, Metabolic and systemic aspects of oncogenesis for new therapeutic approaches (METSY), Paris, France

One-Month activity suspended due to COVID-19

COST Action [CA15211] ElectroNET STSM

Grant winner for the short-term mission

Title: "Complete analysis to reach a full comprehension of the destabilizing effect of pulsed electric fields like atmospheric lightning signals on lipid vesicles"

Home Institution: Sapienza University of Rome, Italy

Host Institution: CNRS - University of Paris-Saclay - Gustave Roussy UMR 9018, Metabolic and systemic aspects of oncogenesis for new therapeutic approaches (METSY), Paris, France

ACADEMIC ACTIVITIES

Seminars and Practical lessons
A.A. 2018/19 – 2019/2020 – 2020/2021

Master Course of Electromagnetic Fields and Nanosystems under the direction of Prof. Micaela Liberti

I show my research activity in the framework of the application of electromagnetic fields on biological tissue, for therapeutic and diagnostic purposes. Practical lessons on the use of advanced equipment for electric field application. Practical lessons on the use of basic and advanced software to both study the interaction of electromagnetic fields with biological tissues and perform

the post-processing of experimental data.

Seminars and Practical lessons
A.A. 2018/19 – 2020/2021

Bachelor Course of Electromagnetic Fields under the direction of Prof. Apollonio Francesca

Practical lessons on the use of basic software to both study the electromagnetic fields propagation.

Trainer for Bachelor and Master students
A.A. 2018/19 – 2019/2020 – 2020/2021

- Bachelor students in Clinical Engineering, under the direction of Prof. Francesca Apollonio, Micaela Liberti and Alessandra Paffi,
- Master students in Nanotechnology Engineering, under the direction of Prof. Francesca Apollonio.
- Master students in Electronic Engineering, under the direction of Prof. Francesca Apollonio and Prof. Micaela Liberti.

AWARDS

2019 **BioEM2019 Joint Annual Meeting, Montpellier, France: Student Travel Award**

2019 **EuMW2019 49th European Microwave Conference, Paris, France: Student Award**

2020 **EuMW2020 50th European Microwave Conference, Utrecht, Netherlands: Student Award**

SCHOOL PARTECIPATION

04 - 08 February 2019

Full-time participation to the XXIII International School of Pure and Applied Biophysics on "Emerging Tools in Biomechanics: from tissues down to single molecules", Venice, Italy.

I studied through theoretical lessons, in silico tutorials and experimental activities the importance of mechanical properties in biological processes, from molecular and sub-cellular approaches to single cell and tissues.

14 - 16 October 2019

Full-time participation to the High Performance Molecular Dynamics course by CINECA, Rome, Italy

I learned how to perform molecular dynamic simulations reducing computational costs of the simulations.

14 January 2021

Full-time participation to the Tom Brazil Doctoral School of Microwaves by the European Microwave Week EUMW2020, Utrecht, The Netherlands

School title: "The Route to 5G: Design of mmWave Active Array Systems, from RFIC to Signal Processing". The overall theme of the technical topics is 5G mmWave with a focus on the design of integrated active array systems, covering the fields all the way from RFIC to signal processing.

EXAMINATION OF INTEREST

Chemical Engineering

Passed the following exams:

- Separation Fundamentals, with a grade of 28 out of 30
  - Deep study of material balances in both stationary and non-stationary conditions.
  - Well assessed knowledge of chemical equilibria and energy, mass and heat conservation principles.
  - Good knowledge of project calculus and verify for multi-stage process equipment.
  - Technologies of Applied Chemistry, with a grade of 30 out of 30
  - Competence on chemical process and water treatments.
  - Good knowledge of chemical-physical properties of water, water solutions and suspensions.

- Material Science, with a grade of 27 out of 30
  - Good knowledge of atoms bonding, structure and geometry of crystalline solids.
  - Deep study of mechanical and chemical-physical properties of all materials types.
  - Chemical plants, with a grade of 29 out of 30
  - Learned how to do the sizing of chemical plants equipment, including heat and mass exchangers.

- Industrial chemical processes, with a grade of 28 out of 30
  - Learned to apply basic chemical knowledges to obtain a complete process scheme.
  - Good knowledge of catalytic reactions and security fundamentals.

- Industrial organic chemistry, with a grade of 26 out of 30
  - Well assessed knowledge of organic chemistry and reactions used in chemical industry.
  - Study of geometrical structures of organic substances and the capability to react of their functional groups.

Nanotechnology Engineering:

Passed the following exams:

- Superior chemistry and Electrochemistry laboratory, with a grade of 30 out of 30 cum laude
  - Deep study of redox reactions and electrochemistry.
  - Studied all corrosion types and new chemistry applications in nanotechnologies.
  - Course presentation: “Nanoparticles transport of chemotherapy drugs: fundamentals and examples”.

- Quantum physics with structures of matter fundamentals, with 30 out of 30.
  - Study of the quantum mechanics theory and application of quantum approach to specific problems.
  - Good knowledge of the quantum models applications on crystals to study properties of both standard and nanostructured materials.

- Macromolecular structures and principles of biochemical engineering, with a grade of 30 out of 30 with laude.
  - Study of the molecular and cellular biology, the biochemical and thermodynamic mechanisms regulating functions of the macromolecules and the living organisms, from a molecular point of view.
  - Deep understanding of subcellular processes, including microorganisms ones.
  - Deep study of processes of enzymes, of genetic regulation and growth of microorganisms and cellular lines, through a quantitative description.

- Micro-nano fluidics and micro-nano fluidic devices, with 28 out of 30
  - Good understanding of fluids behaviour in micro-nano devices and their mechanism of interaction with different kinds of surface.
  - Deep knowledge of fluids motion for the project of nanotechnology applications.

- Models and techniques of atomistic simulation, with a grade of 30 out of 30.
  - Good knowledge of the Lagrangian and Hamiltonian mechanics and the theory of statistical mechanics, including Monte-Carlo techniques.
  - Learned about the classical Molecular Dynamics, with equations of motion integrations.
  - Studied the classical potential, the quantum theory of multi-bodies systems and the density functional theory.

- Laboratory of atomistic and micro-fluidic simulations, with a grade of 30 out of 30.
  - Learn how to apply statistical mechanics and Molecular dynamics techniques to implement and run simulations, using the right operative instruments and codes.

  - Deep focus on electronic structure study and implementation of micro and nano-fluidic simulations, including a critical analysis of simulation results and limitations.
  - Course simulation projects: Determination of solid-fluid contact angle from Molecular Dynamics simulations; Plane Couette flow between two parallel plates; Metropolis-Monte-Carlo simulation of a Lennard-Jones fluid above its critical temperature; Micro-canonical and canonical Molecular Dynamics of a Lennard-Jones fluid above the critical temperature; Tersoff models potentials for silicon; Quantum models: the tight binding approximation for silicon, the density of states and the Young moduli.

- Electromagnetic fields and nanosystems for biomedical applications, with a grade of 29 out of 30.
  - Deep study of electromagnetic fields with Maxwell equations, transmission lines and radiation principles.
  - Well assessed knowledge of biological interfaces and dielectric properties of tissues.
  - Study of Molecular Dynamics simulations, with quantum mechanics and coarse-grained molecular mechanics.
  - Good knowledge of microdosimetry, using the software COMSOL Multiphysics, and application of electric and magnetic fields to trigger drug delivery systems.

- Laboratory of biochemical instrumentation, with a grade of 30 out of 30.
  - Deep study of statistical inference and experimental design
  - Laboratory experiences/project: Cellular growth determination of microalgae inoculum in two different cultures, Microalgae characterization of carbohydrates and lipids; Copper biosorption on microalgal biomass; electrodeposition of cobalt nanoparticles onto an aluminium sheet.

Other classes taken:

- Micro electromechanical systems and laboratory
  - MEMS project: Design of molecular detection using variable capacity capacitor.
- Microscopy and nanocharacterization techniques
- Nanostructure fabrication technologies and self-assembly processes

PERSONAL SKILLS

TECHNICAL SKILLS AND COMPETENCES

- Good knowledge of Windows and Linux operating Systems.
- Good command of office suite (word processor, spread sheet, presentation software)
- Programming languages: Awk, Fortran, basic knowledge of C++.
- Software: LAMMPS, VMD, GNUPLOT, AutoCAD 2D, ImageJ, Matlab, COMSOL, Ansys HFSS, basic knowledge of Labview.
- Laboratory equipment: Electrical Nanopulse Generator, Oscilloscope, Vector Network Analyzer, chromatograph for HPLC, pH meter, Atomic Absorption Spectrometer, Scanning Electron Microscope, Spectrofluorometer, Spectrometer.

COMMUNICATION AND ORGANIZATIONAL SKILLS

- Good intercultural communication skills enhanced through my one month long experience in EF International House, Boston USA, and during my participation in the Model United Nation, New York USA (March 2011).
- Leadership, good team-working, problem solving and organizational skills gained working in group projects for some exams and collaborating with other laboratory groups during my thesis and PhD.
- Commitment and flexibility gained through my university experience.
- B2 level of English.

Other skills

- Love cinematography, watching movies. Like planning trip around the world, discover different cultures and meeting new people.

LIST OF PUBLICATIONS

- A. Denzi, C. Merla, **L. Caramazza**, A. De Angelis, F. Apollonio and M. Liberti, "Microdosimetry in Biomedical Applications: Importance of Realistic Models at the Cellular and Subcellular Levels" for 2018 EMF-Med 1st World Conference on Biomedical Applications of Electromagnetic Fields (EMF-Med), 10-13 September 2018, Split, Croatia.
- **L. Caramazza**, M. Nardoni, A. De Angelis, P. Paolicelli, S. Petralito, M. Liberti and F. Apollonio, "Feasibility of drug delivery mediated by ultra-short and intense pulsed electric fields" for 2018 ICEmB 5th National Conference on Interactions between Electromagnetic Fields and Biosystems, 28-30 November 2018, Salerno, Italy.
- **L. Caramazza**, M. Nardoni, A. De Angelis, E. della Valle, A. Denzi, P. Paolicelli, C. Merla, M. Liberti, F. Apollonio, and S. Petralito, "Feasibility of drug delivery mediated by ultra-short and intense pulsed electric fields" (2019) Manuscript 1311 submitted to 2019 41st Annual International Conference of the IEEE Eng. in Med. and Biol. Soc. (EMBC). The paper is published in IEEEXplore.
- **L. Caramazza**, A. De Angelis, E. della Valle, A. Denzi, M. Nardoni, P. Paolicelli, S. Petralito, F. Apollonio, and M. Liberti, "Numerical Investigations of CW Electric Fields on Lipid Vesicles for Controlled Drug Delivery", Manuscript ID 4148 submitted to 2019 49th European Microwave Conference (EuMW 2019). The paper is published in IEEEXplore.
- **L. Caramazza**, M. Nardoni, A. De Angelis, E. della Valle, A. Denzi, P. Paolicelli, C. Merla, M. Liberti, F. Apollonio, and S. Petralito, "nsPEFs exposure of liposomes to explore controlled drug delivery applications", for BioEM2019, Montpellier, France, Jun 23 - 28, 2019.
- **L. Caramazza**, A. De Angelis, E. della Valle, A. Denzi, M. Nardoni, P. Paolicelli, S. Petralito, F. Apollonio, and M. Liberti, "Numerical investigations on the action of CW electric fields on lipid vesicles for drug delivery", for BioEM2019, Montpellier, France, Jun 23 - 28, 2019.
- I. Zironi, G. D'Amen, A. De Angelis, **L. Caramazza**, A. Gabrielli and G. Castellani, "Is an electrostatic field able to induce a galvanotactic phenomenon? Investigation in a scrape wound model", for BioEM2019, Montpellier, France, Jun 23 - 28, 2019.
- **L. Caramazza**, M. Nardoni, A. De Angelis, P. Paolicelli, S. Petralito, M. Liberti, and F. Apollonio, "Lipid vesicles exposed to nsPEF for drug delivery applications", for the 3rd WC2019, Toulouse, France, Sep 3-6, 2019.
- S. Petralito, M. Liberti, M. Nardoni, **L. Caramazza**, A. De Angelis, C. Merla, E. della Valle and F. Apollonio, "Drug delivery through liposomes carriers mediated by pulsed electric and magnetic fields: experimental and modelling studies", for a workshop at the 2019 49th European Microwave Conference (EuMW 2019) Paris, France, 29-4 October 2019.
- **L. Caramazza**, Annalisa De Angelis, Daniel Remondini, Gastone Castellani, Micaela Liberti, Francesca Apollonio, and Isabella Zironi "Galvanotactic Phenomenon Induced by Non-Contact Electrostatic Field: Investigation in a Scratch Assay", Manuscript 1540 submitted to 2020 42st Annual International Conference of the IEEE Eng. in Med. and Biol. Soc. (EMBC) in conjunction with the 43rd Annual Conference of the Canadian Med. and Biol. Eng. Soc. The paper will be published in IEEEXplore.
- P. Marracino, **L. Caramazza**, M. Liberti and F. Apollonio, "Electroporation Mechanisms: The Role of Lipid Orientation in the Kinetics of Pore Formation", Manuscript 1512 submitted to 2020 42nd Annual International Conference of the IEEE Eng. in Med. and Biol. Soc. (EMBC) in conjunction with the 43rd Annual Conference of the Canadian Med. and Biol. Eng. Soc. The paper will be published in IEEEXplore.
- S. Petralito, M. Nardoni, P. Paolicelli, M.A. Casadei, Laura Di Muzio, **L. Caramazza**, M. Liberti and F. Apollonio, "Non-thermal electromagnetic fields to trigger on-demand drug release from high-Tm Magnetoliposomes 21st International Conference and Exhibition on Pharmaceutics & Novel Drug Delivery Systems. Italy, Rome, 11-12 March 2020.
- **L. Caramazza**, A. De Angelis, M. Nardoni, P. Paolicelli, S. Petralito, F. Apollonio, and M. Liberti, "Planning Sine Waves Electroporation on Liposomes for Drug Delivery Application", 2020 IEEE MTT-S International Microwave Biomedical Conference (IMBioC). Tolouse, France 14-17 December 2020. The paper will be published in IEEEXplore.
- **L. Caramazza**, A. Paffi, M. Liberti and F. Apollonio, "A Coplanar Waveguide System for Drug Delivery Mediated by Nanoelectroporation: an Experimental and Numerical Study", Manuscript ID 5871 submitted to 2020 50th European Microwave Conference (EuMW 2020). The Netherlands, Utrecht, 10-15 January 2021. The paper is published in IEEEXplore.
- **L. Caramazza**, M. Nardoni, A. De Angelis, P. Paolicelli, M. Liberti, F. Apollonio, and S. Petralito, "Proof-of-concept of electrical activation of liposome nanocarriers: from dry to wet experiments", Frontiers in Bioengineering and Biotechnology, Bioprocess Engineering, 2020. doi: 10.3389/fbioe.2020.00819.
- **L. Caramazza,** A. Paffi, M. Liberti and F. Apollonio, "Experimental and Numerical Characterization of a Grounded Coplanar Waveguide for Nanoelectroporation Applied to Liposomes", *under review* to EuMW2020 Special Issue of the International Journal of Microwave and Wireless Technologies (IJMWT).
- P. Marracino, **L. Caramazza**, M. Montagna, R. Ghahri, M. D'Abramo, M. Liberti and F. Apollonio, "The architects of electric-driven membrane poration: a rationale for water role in the kinetics of pore formation", *submitted* to the Journal of Bioelectrochemistry.
- **L. Caramazza,** J. Trilli, P. Paolicelli, S. Petralito, M.A. Casadei, M. Liberti and F. Apollonio, "Magnetoliposomes for Controlled Drug Delivery using Low-Strength Magnetic Field: a Review", *under preparation* for Colloids and Surfaces B: Biointerfaces.

Rome, 12th of January 2021 Signature