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Cristina Cantarutti

Nationality: Italian

Born in San Daniele del Friuli (Italy), July 12th 1990

Present occupation

Jan 2022-present Research Associate (**Ricercatore a tempo determinate tipo A, SSD FIS/07**)
Biophysics group of the University of Udine (Italy)

Past experience

Sept 2021-Dic 2021 **Post-doc** at the **Biophysics group** of the University of Udine (Italy)
Supervisors: Prof. A. Corazza.
Project: NMR study of the interaction between TTR and ligands in human serum.

Sept 2020 – Sept 2021 **Post-doc** at the **Biophysics group** of the University of Udine (Italy)
Supervisors: Prof. M. Zancani.
Project: Study of the interactions between OSCP and CyP-D in modulation of the mitochondrial permeability transition pore by NMR spectroscopy.
Parallel projects: a) investigation of TTR interaction with potential drug molecules by NMR; b) characterization of TDP43 N-terminal domain in collaboration with Prof. F. Chiti from University of Florence

Apr 2019 – Dec 2019 **CNRS post-doc** at the Institut de Chimie de Nice of the University of Nice (**France**) in the **Equipe Matériaux et Polymères Eco-compatibles** (European project KaRMA2020).
Supervisor: Prof. A. Mija.
Project: molecular characterization of cross-linked polymer composites from renewable sources by IR and NMR spectroscopies.

Jan 2018 – Jan 2019 **Post-doc** at the **Biophysics group** of the University of Udine (Italy) in collaboration with the cardio-surgery division of the Udine University Medical School
Supervisor: Prof. G. Esposito.
Project: metabolomics by NMR of blood samples from heart transplanted patients related to different organ conservation systems.

Career breaks

Aug 2018 – Maternity leave
Apr 2019

Jun 2023 –
Nov 2023

Academic education

Nov 2014 – **PhD in Biomedical Sciences and Biotechnology** at the **Biophysics group** of the University of Udine (Italy). Supervisor: Prof. G. Esposito; co-supervisor: Prof. A. Corazza.
Oct 2017 Project: characterization of amyloidogenic protein stability, dynamics and molecular interactions with synthesized nanoparticles, molecular chaperones, supramolecular systems and small peptides.
PhD thesis “Challenging protein-nanoparticle interactions. Results with gold nanoparticle and β 2-microglobulin system”. Thesis defense: 02/03/2018.

Jul 2014 **Master degree in Organic and Biomolecular Chemistry** at the University of Trieste (Italy).
Thesis in organic and nanomaterial chemistry: “Carbon nanotubes functionalization for biomedical applications”.
Supervisor: Prof. M. Prato; co-supervisor: Dr. S. Bosi.
Final grade: 110/110 with honours.

Jul 2012 **Bachelor degree in Chemistry** at the University of Trieste (Italy).
Thesis in organic and nanomaterial chemistry: “Synthesis and characterization of hydrogenated/fluorinated mixed monolayer protected gold clusters”.
Supervisor: Prof. L. Pasquato; co-supervisor: Dr. S. Bidoggia.
Final grade: 110/110 with honours.

Research experience abroad during PhD

Two months at the New York University of Abu Dhabi (UAE) as a visiting PhD student.

Publications

- 1) **Cantarutti C**, Mimmi MC, Verona G, Mandaliti W, Taylor GW, Mangione P, Giorgetti S, Bellotti V, Corazza A. (2022) Calcium binds to transthyretin with low affinity. *Biomolecules*
- 2) Moretti M,* Marzi I,* **Cantarutti C**, Vivoli Vega M, Mandaliti W, Mimmi MC, Bemporad F, Corazza A, Chiti F. (2022) Conversion of the native N-terminal domain of TDP-43 into a monomeric alternative fold with lower aggregation propensity. *Molecules*, 27: 4309.
*equal contribution

- 3) **Cantarutti C**,* Hunashal Y,* La Rosa C, Condorelli M, Giorgetti S, Bellotti V, Fogolari F and Gennaro E (2022) The corona of protein–gold nanoparticle systems: the role of ionic strength. *Phys Chem Chem Phys*, 24: 1630-1637.
*equal contribution
- 4) **Cantarutti C***, Vargas MC, Dongmo Founthum C, Dumoulin M, La Manna S, Marasco D, Santambrogio C, Grandori R, Scoles G, Soler MA, Corazza A and Fortuna S* (2021) Insights on peptides topology in the computational design of protein ligands: the example of lysozyme binding peptides. *Phys Chem Chem Phys*, 23: 23158-23172.
*corresponding authors
- 5) Prakasam T, Hunashal Y, **Cantarutti C**, Giorgetti S, Faravelli G, Mondani V, Sharma S.K., Jagannathan R, Palmisano G, Bellotti V, Fogolari F, Olsen J-C, Trabolsi A and Esposito G (2021) Topologically non-trivial metal-organic assemblies inhibit amyloidogenesis. *Cell Reports Physical Science*, 2: 100477-100498.
- 6) Hunashal Y, **Cantarutti C**, Giorgetti S, Marchese L, Fogolari F and Esposito G (2020) Insights into a Protein-Nanoparticle System by Paramagnetic Perturbation NMR Spectroscopy. *Molecules*, 25(21): 5187-5201.
- 7) **Cantarutti C**, Dinu R and Mija A (2020) Polyhydroxybutyrate bioresins with high thermal stability by crosslinking with resorcinol diglycidyl ether. *Biomacromolecules*, 21(8): 3447–3458.
- 8) Dinu R, **Cantarutti C** and Mija A (2020) Design of sustainable materials by crosslinking a bio-based epoxide with keratin and with lignin. *ACS Sustainable Chem. Eng*, 8(17): 6844-6852.
- 9) Hunashal Y, **Cantarutti C**, Giorgetti S, Marchese L, Molinari H, Niccolai N, Fogolari F and Esposito G (2020) Exploring exchange processes in proteins by paramagnetic perturbation of NMR spectra. *Phys Chem Chem Phys*, 22: 6247-6259.
- 10) **Cantarutti C**, Dinu R. and Mija A (2019) Biorefinery Byproducts and Epoxy Biorenewable Monomers: A Structural Elucidation of Humins and Triglycidyl Ether of Phloroglucinol Cross-Linking. *Biomacromolecules*, 21(2): 517-533.
Supplementary cover published
- 11) **Cantarutti C**, Fogolari F, Hunashal Y, Ferrara V, Caragnano A, et al. (2019) Assessing the Effect of Preservation in Heart Transplant Protocol: Cold Ischemia Versus Normothermic Perfusion. *Biomark Applic*, 3:139-149.
- 12) S. Sponga, V. Ferrara, A.P. Beltrami, A. Bonetti, **Cantarutti C**, A. Caragnano, F. Ortolani, A. Lechiancole, R. Esposito, C. Di Nora, V. Tursi, C. Nalli, U. Livi (2019) Ex-vivo Perfusion on Marginal Donors in Heart Transplantation: Clinical Results and Pathological Findings. *J Heart Lung Transplant*, 38(4):S42-S43
- 13) **Cantarutti C**, Raj G., Fogolari F., Giorgetti S., Corazza A., Bellotti V., Naumov P. and Esposito G. (2018) Interference of citrate-stabilized gold nanoparticles on β 2-microglobulin oligomeric association. *Chem Commun*, 54: 5422-5425.
- 14) **Cantarutti C**., Bertocin P., Giorgetti S., Bellotti V., Fogolari F. and Esposito G. (2018) The

interaction of β 2-microglobulin with gold nanoparticles: impact of coating, charge and size. *J Mater Chem B*, 6: 5964-5974.

- 15) Brancolini G., Maschio M. C., **Cantarutti C.**, Corazza A., Fogolari F., Bellotti V., Corni S., Esposito G. (2018), Citrate stabilized Gold Nanoparticles interfere with Amyloid Fibril formation: D76N and Δ N6 β 2microglobulin variants. *Nanoscale*, 10: 4793-4806.
- 16) Sponga S., Ferrara V., Beltrami A., Bonetti A., **Cantarutti C.**, Caragnano A., Esposito G., Lechiancole A., Guzzi G., Meneguzzi M., Nalon S., Ortolani F., Piani D., Livi U. (2018) Oc55 Outcome of Heart Transplantation with Marginal Donors: Cold Storage Vs Normothermic Perfusion. *J Cardiovasc Med*, 19: e27.
- 17) **Cantarutti C.**, Raimondi S, Brancolini G, Corazza A, Giorgetti S, Ballico M, Zanini S, Palmisano G, Bertoincin P, Marchese L, Mangione P, Bellotti V, Corni S, Fogolari F, Esposito G (2017), Citrate-stabilized Gold Nanoparticles hinder fibrillogenesis of a pathologic variant of β 2-microglobulin. *Nanoscale*, 9: 3941-3951.
- 18) **Cantarutti C.**, Bertoincin P., Corazza A., Giorgetti S., Mangione P. P., Bellotti V., Fogolari F. and Esposito G. (2017), Short-chain alkanethiol coating for small-size gold nanoparticles supporting protein stability. *Magnetochemistry*, 3: 40-51.
- 19) Soler MA, Rodriguez A, Russo A, Adedeji AF, Dongmo Fomthui CJ, **Cantarutti C.**, Ambrosetti E, Casalis L, Corazza A, Scoles G, Marasco D, Laio A, Fortuna, S (2017), Computational design of cyclic peptides for the customized oriented immobilization of globular proteins., *Phys Chem Chem Phys*, 19: 2740-2748.
- 20) Şologan M, **Cantarutti C.**, Bidoggia S, Polizzi S, Pengo P, Pasquato L (2016), Routes to the preparation of mixed monolayers of fluorinated and hydrogenated alkanethiolates grafted on the surface of gold nanoparticles. *Faraday Discuss.*, 191: 527–543.
- 21) Bosi S, Fabbro A, **Cantarutti C.**, Mihajlovic M, Ballerini L, Maurizio P (2016), Carbon based substrates for interfacing neurons: Comparing pristine with functionalized carbon nanotubes effects on cultured neuronal networks. *Carbon*, 97: 87-91.

Membership

- GIDRM - Italian Group of Discussion concerning Magnetic Resonance
- INBB – National Institute of Biostructures and Biosystems (Interuniversity Consortium)

National Scientific Qualification

29/09/2023-29/09/2034 National Scientific qualification as associate professor in the Italian higher education system, in the call 2021/2023 (Ministerial Decree n. 553/2021 and 589/2021) for the disciplinary field of 02/D1 - Applied physics, physics teaching and history of physics. SSD FIS/07

Awards and grants

Pfizer Research Grant Junior Investigator Global ATTR Amyloidosis Research (role: PI) – December 2022

- November 2024

Attendance grant for Italian-French International Conference on Magnetic Resonance – 27-30 September 2022, Milan IT

Young Researchers Fellowship for International Workshop on Advanced Isotopic Labelling Methods – 13-16 September 2022, Grenoble FR

Editorial activity

Guest Editor for *Molecules* Special Issue “NMR in Biochemical Research: From Small Molecules to Macromolecular Complexes”

Reviewer for *Life*, *Molecules*, *International Journal of Biological Macromolecules*

Research topics

- **protein NMR** spectroscopy (two-dimensional experiments, chemical shift perturbation mapping, saturation transfer difference, diffusion ordered spectroscopy, trossy for rotational correlation time, amide exchange experiments, backbone dynamics analysis through ¹⁵N relaxation experiments, reduced spectral density mapping, relaxation dispersion experiments, paramagnetic perturbation);
- basics of **protein molecular dynamics simulations**
- **small molecule NMR** (structure determination through mono- and two-dimensional homo- and hetero-nuclear experiments and conformation investigation through 1D and 2D NOE and ROE experiments);
- **NMR metabolic profiling** of plasma, serum and biopsies (mono-dimensional relaxation edited and two-dimensional experiments)
- molecular characterization of cross-linked polymer composites by **ATR-FTIR** and **NMR**;
- characterization of **protein molecular interactions** by techniques other than NMR such as **fluorescence** spectroscopy, **dynamic light scattering**, **UV-Vis** spectroscopy, microscopy (**AFM**, **TEM**), **quartz crystal microbalance** (QCMD) and **surface-enhanced Raman spectroscopy** (SERS);
- **protein amyloid aggregation** investigation by several techniques like **fluorescence** spectroscopy, **electron microscopy** and **soluble fraction analysis** (competence gained through a training at the Biochemistry Institute of the University of Pavia -Italy);
- **nanomaterials** (gold nanoparticles and carbon nanotubes) synthesis, functionalization and characterization (UV-Vis, TEM, AFM, TGA, DLS, ζ-potential);
- **organic synthesis, purification and characterization of organic compounds.**

Job-related skills

- **Calibration and acquisition** of NMR experiments, knowledge of **Bruker pulse programming**;
- use of **scientific data analysis softwares** (Origin, R, xmgrace, ImageJ), NMR processing and analysis softwares (Topspin, Sparky, NMRPipe, Mestrenova, Dynamics Center), chemical structure drawing programs (Chem Draw and Chem Draw 3D) and molecular graphics softwares (Pymol);
- use of **linux** environment and **bash scripting**;
- use of softwares to perform and analyse **MD simulations** (NAMD and VMD);
- knowledge of main **spectroscopic techniques** (NMR, UV-Vis, fluorescence, DLS, IR), microscopies (TEM, AFM), other characterization techniques like thermogravimetric analysis and mass spectrometry, QCMD and basic purification techniques (extraction and chromatography);
- **laboratory management** and attested **safety laboratory practice**;
- manipulation of **cryogenic** fluids;
- **communication skills** (oral and poster contributions, paper writing).

Schools, training and congresses

May 2023	NMR symposium at ISTA (Austria) Poster presentation: TRANSTHYRETIN VARIANTS: SAME STRUCTURE, DIFFERENT BEHAVIOUR
Mar 2023	XXI Telethon convention (Riva del Garda, Italy) Poster presentation: TRANSTHYRETIN VARIANTS: SAME STRUCTURE, DIFFERENT BEHAVIOUR
Sept 2022	Italian-French International Conference on Magnetic Resonance (Milan, Italy) Poster presentation: THE AMYLOIDOGENIC PROTEIN TRANSTHYRETIN REVEALS A COMPLEX DYNAMIC LANDSCAPE ON MULTIPLE TIMESCALES
Sept 2022	AILM2022
Nov 2021	Dissemination event on the project Alt Frialty Udine Oral presentation:
Aug 2021	CCPN Conference 2021
May 2021	WebPro – Proteins on the Web 2021 organized by Società Italiana di Biochimica (Gruppo Proteine)

Poster contribution: Cristina Cantarutti, Walter Mandaliti, Guglielmo Verona, Vittorio Bellotti, Patrizia Mangione, Mark B. Pepys, Alessandra Corazza
Hydrogen-deuterium exchange reveals increased conformational fluctuations in the amyloidogenic V122I variant than in wild-type transthyretin

- Feb 2021 - Mar 2021 Bio-NMR training by Dr. Helena Kovacs from Bruker (theory and practice). Topics : triple resonance, side chain experiments, fast methods, relaxation and power handling, X-detected experiments and screening and binding.
- Mar 2021 LINXS Amyloid Workshop - Heart and Mind: linking in vitro science to the clinical context
- Oct 2020-Dic 2020 Seminars on NMR relaxometry, University of Udine.
Oral presentation: Relaxation dispersion methods.
- Oct 2020 Shell programming course (University of Udine)
- Jan 2021 Webinars on Emerging Topics in Biomolecular Magnetic Resonance : ‘Transient structures in IDPs from 3D NUS NMR of chemical denaturation’ Ad Bax (NIDDK/NIH) and ‘Time Travel to the Past and Future – Evolution of energy landscapes for enzymes catalysis’ Dorothee Kern (Brandeis University).
- Dec 2020 Webinar ‘NMR studies of the role of large-scale dynamics in the replication machinery of human RNA viruses’ Martin Blackledge (Institut de Biologie Structurale, UMR 5075, Grenoble)
- Dec 2019 Towards a cure for amyloid diseases: a successful example of precision and translational medicine. Pavia (Italy)
Oral presentation as Invited Speaker Molecular knots: a possible approach to interfere with β 2m fibrillogenesis.
- Mar 2018 Statistics for Medicine and Biology course. Udine
- Nov 2017 Advances in NMR and MS Based Metabolomics GIDRM congress. Padova
Poster contribution: Cristina Cantarutti, Veronica Ferrara, Antonio Beltrami, Ugolino Livi, Sandro Sponga, Gennaro Esposito.
NMR metabolomics of blood samples from heart transplanted patients related to different organ conservation systems.
- Sept 2017 GIDRM XLVI National Congress on Magnetic Resonance. Salerno
Poster contribution: Cantarutti C, Wilson M.R., Carver J.A., G. Esposito G.
Hydrodynamics of β 2-microglobulin in presence of two molecular chaperones by NMR
- Jun 2017 GIDRM NMR Day: HR-MAS NMR, metabolomics and multivariate analysis. Milan
- May 2017 PhD Expo. Udine

- Oct 2016 **Poster contribution:** Cantarutti C, Raimondi S, Corazza A, Giorgetti S, Esposito G. Citrate-stabilized Gold Nanoparticles hinder fibrillogenesis of a pathologic variant of β 2microglobulin
- Sep 2016 GIDRM Advanced NMR school: product operator formalism, pulse sequences, molecular motions, relaxation, diffusion, hyperpolarization, solid state NMR, MRI. Turin
- Sep 2016 Nanomedicine Congress, Viterbo
Poster contribution: Cantarutti C, Corazza A, Raimondi S, Giorgetti S, Bellotti V, Fogolari F, Esposito G, Effect of citrate stabilized gold nanoparticles on β 2-microglobulin fibrillation process.
- Feb 2016 International Summer School Nanoscience meets Metrology: Synthesis, Characterization, Testing and Applications of Validated Nanoparticles, Turin
Oral contribution: Cantarutti C, Corazza A, Raimondi S, Giorgetti S, Bellotti V, Fogolari F, Esposito G, Citrate gold nanoparticle interaction with β 2microglobulin: nanoparticle-protein adduct formation. (**Awarded between the three best oral presentations**)
- Sep 2013 International Chemistry Conference on Organic and Bioorganic Chemistry, Abu Dhabi
Poster and oral contribution: Cantarutti C, Corazza A, Raimondi S, Giorgetti S, Bellotti V, Fogolari F, Esposito G, Gold nanoparticles and amyloidogenic proteins: exploiting the interaction to avoid fibrillogenesis. (**Awarded as best poster presentation**)
- Nanomedicine School, Trieste

Teaching and mentoring activities

- Apr 2023- Apr 2025 Supervisor of postdoc Dr. Isabella Ottenio de Lourenco (University of Udine)
- Dec 2020 Co-supervisor of Giovanni Crump bachelor thesis (University of Udine)
- Academic year 2021-2022; 2022-2023 62 hours of Applied Physics for Health Professions courses (FIS/07). University of Udine
- Feb – May 2021 Physics and Chemistry courses for Health Profession entrance exam. Liceo Uccellis, Udine
- Oct 2020 Physics preparatory course, Health Professions course (FIS/07). University of Udine
- Feb – May 2018 Chemistry course for Medicine entrance exam. Unid Formazione, Udine.

Nov – Dec 2017 Science teacher (J. Linussio high school, Codroipo UD)

Oct 2017 Physics preparatory course, Health Professions course (FIS/07). University of Udine.

Languages

Italian: mother tongue. **English:** advanced. **French:** pre-intermediate. **German:** pre-intermediate.

Udine, 29/09/2023



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