EUROPEAN FORMAT FOR CURRICULUM VITAE

PERSONAL INFORMATION

Surname and Name

REDOLFI-BRISTOL, Davide

EDUCATION AND TRAINING

• September 2021 – February 2025 (expected thesis defence)

THESIS SUBMITTED ON 20/09/2024

***Double PhD degree* programme in Science and Technology of Bio and Nanomaterials (Ca' Foscari University of Venice) and Materials Chemistry (Kyoto Institute of Technology)**

Supervisors: Pietro Riello (Ca' Foscari University of Venice), Giuseppe Pezzotti (Kyoto Institute of Technology)

Thesis title: Cellular Responses and Biomedical Applications of Nanoparticles at Low Concentration Levels

SSD: CHIM/02

The doctoral project focused the attention on the synthesis, characterization, application and toxicological studies of nanoparticles (NPs) at low concentration levels, using advanced techniques of Proteomic Analysis and Raman Microspectroscopy.

Three NPs' types have been selected in the study: gold (AuNPs), silver (AgNPs), and selenium (SeNPs). NPs synthesis has been conducted by reduction methods, while an in-depth characterization has been performed through various techniques to assess the NPs physicochemical properties, such as size (SEM, TEM, SAXS, DLS, Analytical Centrifuge), crystalline phase (XRD, Raman spectroscopy), optical properties (UV-Visible spectroscopy) and porosity (N2 adsorption/desorption). NPs were subsequently tested for their toxicity via *in-vitro* assay on healthy human cells, demonstrating biocompatibility in all cases except for AgNPs. In the case of AuNPs, a more in-depth investigation regarding interactions with cells was carried out via proteomic analysis, showing how small variations occur at the proteomic level despite the absence of obvious signs of cellular damage. In addition, in a different project, AuNPs have been successfully applied as Surface-Enhanced Raman Scattering (SERS) probes to investigate in-vitro the toxicity of NH_3 compound. In the case of AgNPs, a detailed study on cellular defence mechanisms following exposure to these particles was carried out using the Raman Microspectroscopy technique. In this study, variations of specific signals related to antioxidant molecules were detected during the first 24 hours of interaction between NPs and cells. However, with the passage of time these defence mechanisms failed, and a cytotoxic effect of the nanoparticles has been observed. Finally, in a further different project, SeNPs were identified inside human cells using Confocal Raman Microscopy technique, revealing their possible uses as promising imaging probes for this technique.

All the research has been carried out within the Double PhD Degree program in collaboration with Kyoto Institute of Technology (where I spent an overall period of one year)

- Acquired skills: nanoparticles' synthesis (gold, silver, silica, selenium); nanoparticles' characterization techniques (UV-Visible, SEM, TEM, XRD, SAXS, DLS, Analytical Centrifuge, Raman Spectroscopy, N_2 adsorption/desorption)

• October 2022 – March 2023
• September 2023 – April 2024

***Trainee researcher* at Department of Immunology, Kyoto Prefectural University of Medicine, Kyoto, Japan**

Period spent in biological laboratories to carry out the experiments necessary for my doctoral thesis. During this period, I conducted toxicological studies on nanoparticles (AuNPs, AgNPs and SeNPs), growing cells and performing *in-vitro* toxicological assays through both enzyme-linked and chemiluminescence immunoassays.

- Acquired skills: cultivation and maintenance of cell cultures; enzyme-linked assays; in-vitro fluorescence microscopy

• February 2020 – July 2020

***ERASMUS+ Study and Internship* at Universidade de Aveiro, Aveiro, Portugal**

ERASMUS+ period at Universidade de Aveiro (Aveiro, Portugal) conducted doing both an Internship at Centro de Investigação em Materiais Cerâmicos e Compósitos (CICECO) and following master's degree courses (attendance and completion "Human and Environmental Biomarkers" course).

The internship period has been performed under the supervision of Prof. Robert Pullar as an integral part of the master's thesis project. The research project involved the synthesis and characterization of nanostructured and porous titania (TiO_2) materials from the conversion of lignocellulosic biomasses. The synthesis steps included the acid or basic activation and pyrolysis of cork powder; preparation of colloidal solutions of TiO_2 by sol-gel process; vacuum infiltrations through the use of rotavapor; calcinations in the furnace at high temperatures. Materials' characterization was conducted using various compositional and structural investigation techniques (XRD, SEM, UV-vis, FT-IR, N_2 adsorption/desorption).

- Acquired skills: synthesis of porous material (titania) through impregnation techniques; material's characterization techniques (SEM, XRD, N_2 adsorption/desorption)

• September 2018 – October 2020

***Master's Degree* in Science and Technology of Bio and Nanomaterials (LM-53) at Ca' Foscari University of Venice; Grade: 110(cum laude)/110**

Main subjects: Bio and Nanomaterials, Biochemistry, X-ray Diffraction, Microscopy.

Thesis title: Biomorphous porous oxide ceramics, A review

Supervisors: Claudia Crestini (Ca' Foscari University of Venice), Robert C. Pullar (Universidade de Aveiro)

In this thesis the state of the art of highly porous oxide ceramics derived from lignocellulosic materials, also called biomorphous oxide ceramics, is discussed. The thesis aims to provide a complete picture of accessible production procedures, together with the presentation of the most performing practical applications of the various oxide ceramics. New possible research areas are also taken into consideration, in order to lead to the possible opening of new and interesting research directions.

- Acquired skills: advanced bibliographic research; ability to correctly organize acquired data and information

• September 2015 – July 2018

***Bachelor's Degree* in Chemistry and Sustainable Technologies (L-27) at Ca' Foscari University of Venice; Grade: 110(cum laude)/110**

Main subjects: Inorganic Chemistry, Organic Chemistry, Analytical Chemistry, Green Chemistry

Thesis title: From monosaccharides to bio-based platform chemicals: synthesis and functionalization processes.

Supervisor: Prof. Fabio Aricò

In this thesis the synthesis of bio-based platform chemicals, such as 5-hydroxymethylfurfural (HMF) and N-alkyl-5-hydroxymethylpyrrole-2-carbaldehyde (HMPC), starting from renewable resources (fructose and glucose) with the use of green solvents (dialkyl carbonates) and heterogeneous catalysts, is performed. Both the bio-based platform chemicals were subsequently reduced, leading to the formation of the corresponding symmetrical diols which respectively incorporate a furan unit (BHF) or a N-alkyl pyrrole unit (BHP). Finally, the reactivity of the products was investigated through functionalization under different reaction conditions, to expand their field of applications as platform chemicals. The alkylation reaction of the two reduced products, BHF and BHP, was investigated in the presence of alcohols and acid catalysts, while the alkoxycarbonylation reactions were conducted in presence of dialkylcarbonates in basic environment.

- Acquired skills: green organic synthesis (HMF, BHF, HMPC) and purification (solvent extraction and (chromatographic column purification); organic compound's characterization techniques (NMR, GC-MS)

WORK EXPERIENCE

• September 2024 – December 2024

***External teacher* at "Franca Ongaro" Comprehensive Institute middle school, Lido Pellestrina**

External teacher of mathematics for the project ""Actions For Prevention And Contrast To School Dropout" at the "Franca Ongaro" Comprehensive Institute middle school, Lido Pellestrina

• December 2020 – August 2021

Research fellow **at Department of Molecular Sciences and Nanosystems, Ca' Foscari University of Venice**

Project: "Smart fabrics: integrated fabrics with flexible piezoelectric nanocomposites for the production of electrical energy from mechanical energy"

Supervisor: Alvise Benedetti

The research project involved the synthesis of micro and nanostructured materials with perovskitic structure (such as $BiFeO_3$ and $ZnSnO_3$) with hydrothermal and sol-gel methods, and the preparation of piezoelectric composites by combining perovskite materials with piezoelectric polymers (such as Nylon-11). The prepared micro and nanomaterials have been characterized using various compositional and structural investigation techniques, such as SEM, XRD, Raman Spectroscopy and Atomic Force Microscopy (AFM). The incorporation of nanoparticles within the polymer matrix was achieved and optimized by first dissolving the polymer in a well-suited solvent, followed by NPs dispersion through sonication. Eventually, the obtained nanocomposites have been characterized from the piezoelectric point of view through Piezoelectric Force Microscopy (PFM) technique.

- Acquired skills: nanoparticles' synthesis through hydrothermal and sol-gel methods ($BiFeO_3$, $Bi_2Fe_4O_9$, $ZnSn(OH)_6$, Zn_2SnO_4); nanoparticles' characterization techniques (SEM, XRD, Raman Spectroscopy, AFM and PFM)

• June 2021 – August 2021

Visiting Research fellow **at the Funktionale Materialen Institut Fuer Chemie - Humboldt Universitat Berlin, Berlin, Germany**

Project "Smart fabrics: integrated fabrics with flexible piezoelectric nanocomposites for the production of electrical energy from mechanical energy"

Supervisor: Nicola Pinna

Period of work as visiting research fellow at the Funktionale Materialen Institut Fuer Chemie - Humboldt Universitat Berlin (Germany) within the project "Smart fabrics: integrated fabrics with flexible piezoelectric nanocomposites for the production of electrical energy from mechanical energy".

During this period, hydrothermal and microwave synthesis techniques for $BiFeO_3$ and $ZnSnO_3$ perovskite materials were extensively studied. Various instruments were also employed to characterize the nanoparticles produced, using methods such as XRD and TEM.

- Acquired skills: nanoparticles' synthesis through hydrothermal and microwave methods ($BiFeO_3$, $Bi_2Fe_4O_9$, $ZnSn(OH)_6$, Zn_2SnO_4); nanoparticles' characterization techniques (TEM, XRD)

ADDITIONAL INFORMATION

PUBLICATIONS

D. Redolfi-Bristol*, K. Yamamoto, W. Zhu, O. Mazda, P. Riello, E. Marin*, G. Pezzotti, Mapping Selenium Nanoparticles Distribution Inside Cells through Confocal Raman Microspectroscopy (Under submission)

D. Redolfi-Bristol*, K. Yamamoto, E. Marin, W. Zhu, O. Mazda, P. Riello, G. Pezzotti*, Exploring the cellular antioxidant mechanism against cytotoxic silver nanoparticles: a Raman spectroscopic analysis, *Nanoscale* 2024, 16, 9985 - 9997

E. Marin*, **D. Redolfi-Bristol**, A. Rondinella, A. Lanzutti, P. Riello, Statistical approaches to Raman imaging: principal component score mapping, *Anal. Methods* 2024, 16, 2707

D. Redolfi-Bristol*, A. Mangiameli, K. Yamamoto, E. Marin, W. Zhu, O. Mazda, P. Riello, G. Pezzotti*, Ammonia Toxicity and Associated Protein Oxidation: A Single-Cell Surface Enhanced Raman Spectroscopy Study, *Chem. Res. Toxicol.* 2024, 37, 117-125

G. Pezzotti*, T. Adachi, H. Imamura, **D. Redolfi-Bristol**, K. Adachi, T. Yamamoto, N. Kanamura, E. Marin, W. Zhu, T. Kawai, O. Mazda, T. Kariu, T. Waku, F. C Nichols, P. Riello, F. Rizzolio, T. Limongi, K. Okuma*, In Situ Raman Study of Neurodegenerated Human Neuroblastoma Cells Exposed to Outer-Membrane Vesicles Isolated from Porphyromonas gingivalis, *Int. J. Mol. Sci.* 2023, 24, 13351

G. Trapasso, B. Chícharo, T. Gherardi, **D. Redolfi-Bristol**, F. Arico*, Iron(III) Sulfate-Mediated Synthesis of 2,5-Furandicarboxylic Acid Dimethyl Ester from Galactaric Acid, *Catalyst* 2023 13, 1114

M. Annatelli, G. Trapasso, D. Dalla Torre, L. Pietrobon, **D. Redolfi-Bristol**, F. Aricò*, A Green Synthesis of 5,5'-[Oxybis(methylene)]bis-2-Furfural: from By-Product to Attractive Bio-Based

Platform Chemical, *Adv. Sustainable Syst*. 2022, 2200297

D. Redolfi-Bristol, L. Branzi, M. Back, P. Riello, A. Speghini, N. Pinna, A. Benedetti*, $ZnSnO_3$ or Zn_2SnO_4/SnO_2 hierarchical material? Insight into the formation of $ZnSn(OH)_6$ derived oxides, *Inorganics* 2022, 10(11), 183

PROJECTS

Hackathon promoted by Ca' Foscari University of Venice performed in collaboration with "Stevanato Group" - September 2020

CONFERENCES

XXVIII National Congress of Società Chimica Italiana – SCI 2024, August 26th - 30th, 2024 – Milan, Italy - Oral Presentation: "Exploring the cellular antioxidant mechanism against cytotoxic silver nanoparticles: a Raman spectroscopic analysis"

28th International Conference on Raman Spectroscopy – ICORS 2024, July 28th – August 2nd, 2024 – Rome, Italy –Oral Presentation "Mapping Selenium Nanoparticles Distribution in-vitro through Confocal Raman Microspectroscopy"

Interdisciplinary Science Conference in Okinawa - Physics and Mathematics meet Medical Science - ISCO 2023, February 27th – March 3rd, 2023 – Okinawa Institute of Technology (OIST), Japan – Poster presentation: "*Exploring the toxicity mechanism of ammonia: A Surface Enhanced Raman Spectroscopy study*", D. Redolfi-Bristol, A. Mangiameli, E. Marin, W. Zhu, P. Riello, G. Pezzotti

First Symposium of the Association of Italian Researchers in Japan – November 11th, 2022 – Tokyo Japan - Poster presentation: "*$ZnSnO_3$ or Zn_2SnO_4/SnO_2 hierarchical material? Insight into the formation of $ZnSn(OH)_6$ derived oxides*", D. Redolfi-Bristol, L. Branzi, M. Back, P. Riello, A. Speghini, N. Pinna, A. Benedetti

XLVIII Congresso Nazionale di Chimica Fisica – CNCF 2022, July 4th, 2022 – Genoa, Italy - Poster presentation: "*Lead-Free and Bio-based $BiFeO_3$/Nylon-11 nanocomposite as potential Piezoelectric Energy Harvesting Device*", D. Redolfi-Bristol, L. Branzi, M. Back, P. Riello, A. Speghini, A. Benedetti

Online Trilateral Symposium on Bioinspired and Biobased Materials (5th March 2021), Organized by KIT: Kyoto Institute of Technology, Japan; Co-organized by CFUV: Ca' Foscari University of Venice (Italy) and IITG: Indian Institute of Technology Guwahati (India) – Auditor

Nanomaterials at the Frontier of Nanomedicine (5th April 2019), Organized by Department of Molecular Science and Nanosystems of Ca' Foscari University of Venice (Italy) – Auditor

IUPAC Postgraduate Summer School - Sustainability through Green Chemistry (July 2018), Organized by Ca' Foscari University of Venice (Italy) - Auditor

HONOURS AND AWARDS

Winner of the Scholarship "1000 Fellowships Programme" for the participation to XXVIII National Congress of Società Chimica Italiana – SCI 2024

Award as the 3rd best student of the Bachelor's Degree in Chemistry during the first academic year

TUTORING ACTIVITIES AND THESIS SUPERVISION

09.2023-03.2024	Tutoring activity of a Master's degree student (at Kyoto Institute of Technology, Kyoto, Japan) for the thesis entitled "Poly-(l)-lactic acid and Hydroxyapatite nanopowder composite scaffold for bone regeneration in the biomedical field"
09.2022-03.2023	Tutoring activity of a Master's degree student (at Kyoto Institute of Technology, Kyoto, Japan) for the thesis entitled "Experimental and computational study of the interaction of silicon nitride and boron nitride with human cells and microorganisms"
06.2022 – 06.2022 06.2023 – 06.2023 07.2024 – 07.2024	Tutoring activity to 8 high school students in the framework of the PCTO project
04.2022 – 09.2022	Co-supervisor to a Bachelor's degree thesis entitled "Sintesi e caratterizzazione di nanocristalli luminescenti di CeF_3 drogati con ioni Mn^{2+} e Nd^{3+}"
10.2021 – 08.2022	Tutoring activity of a Master's degree student for the thesis entitled "Raman Studies on Functionalized Silica Nanoparticles"

TRAINING AND CERTIFICATIONS	09.2023	11th Course of Transmission Electron Microscopy: theoretical and practical bases - Italian Society for Microscopical Sciences (SISM)
	10.2015 + 08.2022	"Training of workers on health and safety in the workplace" course - high risk (16 hours) + update (6h) at Ca' Foscari University of Venice
	01.2014 - 07.2014	Certificate of proficiency in English, level B2 at Oxford School Venice
PROFESSIONAL SOCIETIES	10.2022 - present	Association of Italian Researchers in Japan (AIRJ)
	06.2022 - present	Società Chimica Italiana (SCI)

PERSONAL SKILLS

MOTHER TONGUE: **ITALIAN**

OTHER LANGUAGE: **ENGLISH (EXCELLENT), SPANISH (GOOD)**

LABORATORY SKILLS

CHEMICAL LABORATORY	9/10	BIOLOGICAL LABORATORY	7/10
SYNTHESIS (GENERAL)	8/10	BIOASSAY	7/10
CHARACTERIZATION (GENERAL)	9/10	FLUORESCENCE MICROSCOPY	6/10
RAMAN SPECTROSCOPY	8/10	DYNAMIC LIGHT SCATTERING (DLS)	7/10
SURFACE-ENHANCED RAMAN SPECTROSCOPY (SERS)	8/10	FOURIER-TRANSFORM INFRARED SPECTROSCOPY (FT-IR)	6/10
ANALYTICAL CENTRIFUGE	8/10	UV-VISIBLE SPECTROSCOPY	8/10
SCANNING ELECTRON MICROSCOPY (SEM)	8/10	TRANSMISSION ELECTRON MICROSCOPY (TEM)	6/10
POWDER X-RAY DIFFRACTION (PXRD)	8/10	ATOMIC FORCE MICROSCOPY (AFM)	7/10
SMALL-ANGLE X-RAY SCATTERING (SAXS)	7/10	NUCLEAR MAGNETIC RESONANCE (NMR)	5/10

COMPUTER SKILLS

INTERNET NAVIGATION	9/10	FIJI (IMAGEJ)	7/10
BIBLIOGRAPHIC RESEARCH	9/10	VESTA (XRD SOFTWARE)	6/10
MICROSOFT OFFICE (WORD, EXCEL, POWERPOINT)	8/10	IMAGE AND VIDEO EDITING SOFTWARE (GIMP, INKSCAPE)	7/10
ORIGIN (DATA ANALYSIS)	8/10	GWYDDION (AFM SOFTWARE)	6/10
CHEMDRAW (CHEMICAL DRAWING)	7/10	PROGRAMMING (C++)	4/10

SOFT SKILLS

TIME MANAGEMENT	10/10	ADAPTABILITY	8/10
ORGANIZATION	10/10	STRESS MANAGEMENT	8/10
TEAMWORK	9/10	CREATIVITY	8/10
PROBLEM-SOLVING	9/10	CONFLICT MANAGEMENT	7/10
COMMUNICATION	8/10	DECISION-MAKING	7/10