



## Program and Book of Abstract of the 1<sup>st</sup> workshop



18 December 2023, 15:00 and 19 December 2023 9:00

Presentations from all the PhD students involved  
in the 4 different Curricula

**Homogeneous Catalysis:** Mechanisms and Applications

**Heterogeneous Catalysis:** Synthesis, Characterization and Applications

**BioCatalysis**

**Novel Technologies for Catalysis**

**Program Coordinator:** Prof. Luigi Vaccaro

*University of Perugia, Italy*

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<http://www.dccb.unipg.it/catalisi>



*1st Workshop of the Italian PhD Program in Catalysis  
Perugia, 18<sup>th</sup> December 2023*

*Palazzo dei Priori, Sala dei Notari*

14:40 -15:00 Registration

15:00 Welcome greetings – **Magnifico Rettore Prof. Maurizio Oliviero, Delegata alla didattica Prof.ssa Carla Emiliani,**  
Presentation of the Teaching Board – *Luigi Vaccaro*

*Homogeneous Catalysis*  
*Chair: Luigi Vaccaro (UNIPG/DCBB)*

15:35 – 15:45 OP1 **Astone Armando** (UNISA)  
*Title: Organocatalytic asymmetric synthesis of epoxides bearing quaternary stereocenters*

15:45 – 15:55 OP2 **Barilli Matteo** (UNIPV)  
*Title: Upcycling of NdFeB SmCo magnets. From e-waste to high-value products. Green&Digital Transition*

15:55 – 16:05 OP3 **Iapadre Debora** (UNIVAQ)  
*Title: Sustainable methodologies via organo-, photo and supramolecular catalysis*

16:05 – 16:15 OP4 **Mancini Jacopo** (UNI Tor Vergata)  
*Title: Catalytic C(sp<sup>3</sup>)-H bond hydroxylations promoted by dioxiranes*

16:15 – 16:25 OP5 **Mannoni Giulia** (UNIUD)  
*Title: Development of highly efficient ruthenium catalysts for sustainable hydrogenation reactions*

16:25 – 16:35 OP6 **Rubello Giovanni** (UNIPD)  
*Title: Gold-based cooperative catalytic systems for the valorization of phenols derived from biomasses*

16:35 – 16:45 OP7 **Tropiano Sofia** (UNICAL)  
*Title: Study of new catalytic processes for the conversion of CO and CO<sub>2</sub> into high value added products*

16:45 – 16:55 OP8 **Zurzolo Simone** (UNISI)  
*Title: Industrial and agricultural solid waste for sustainable catalytic processes*

16:55 – 17:30 *Coffee Break*

*Heterogeneous Catalysis*  
Chair: Barbara Bonelli (POLITO)

- 17:30 – 17:40 OP9 **Catalini Francesco** (UNICAM)  
*Title: The role of catalysis for the development of hybrid filter matrices for sustainable organic transformations*
- 17:40 – 17:50 OP10 **Ferraro Giorgia** (UNIVE)  
*Title: Study and characterization of catalytic systems and their recovery/regeneration*
- 17:50 – 18:00 OP11 **Itri Giulia Maria** (UNIRC)  
*Title: PHOTOWASTE – Synthesis of a new heterogenous photocatalyst for the photoreforming of aqueous solutions of biomass residues*
- 18:00 – 18:10 OP12 **La Greca Eleonora** (UNICT)  
*Title: Catalytic, photocatalytic and photothermo-catalytic reforming reactions for the H<sub>2</sub> production and the subsequent CO<sub>2</sub> valorization*
- 18:10 – 18:20 OP13 **Plavi Federica** (UNIPV)  
*Title: Development and Radiobiology of New Boron Entities*
- 18:20 – 18:30 OP14 **Sang Tian** (UNIPG/DCBB)  
*Title: Synthesis of heterocycles via sustainable heterogeneous C(sp<sup>3</sup>)-H functionalization processes*
- 18:30 – 18:40 OP15 **Trovarelli Letizia** (UNITO/UNIPG/DCBB)  
*Title: Synthesis, characterization, and testing of Metal Organic Frameworks (MOFs) for CO<sub>2</sub> separation and conversion in Mixed Matrix Membranes (MMMs).*

Free time: students are invited to organize a joint activity to know each other, open personal and scientific collaborations

**Dinner “Il Cantinone” at 20:00**

**19<sup>th</sup> December 2023**  
**Palazzo dei Priori, Sala dei Notari**

*Heterogeneous Catalysis*  
Chair: Marco Bandini (UNIBO)

- 9:00 – 9:10 OP16 **Palit Shilpa** (POLIMI)  
*Title: Legislation and policy guidelines for greener sustainable processes*
- 9:10 – 9:20 OP17 **Sciarretta Sara** (UNIVAQ)  
*Title: Development of adsorbents for gases of technological interest from recovered raw materials*

*Biocatalysis*

- 9:20 – 9:30 OP18 **Bigliardi Martina** (UNIMI)  
*Title: Biocatalytic synthesis of bioactive compounds exploiting the acyltransferase from *Mycobacterium smegmatis**
- 9:30 – 9:40 OP19 **Morrone Nelly** (UNIFI)  
*Title: Holistic development of chemical and biological catalysis approaches for the conversion of waste renewable resources into high value-added molecules*
- 9:40 – 9:50 OP20 **Niola Edelberto Oscar** (UNINA)  
*Title: Artificial metalloenzymes for biomass transformation*
- 9:50 – 10:00 OP21 **Voicu Paul George** (UNITO)  
*Title: Engineering of new redox enzymes for the sustainable production of molecules with high added value*

*Novel Technologies for Catalysis*  
Chair: Claudia Antonetti (UNIFI)

- 10:00 – 10:10 OP22 **Edoardo Bazzica** (UNIPG/DCBB)  
*Title: Green and circular strategies for biowaste valorization*
- 10:10 – 10:20 OP23 **Bruschetta Chiara** (UNITO)  
*Title: Technologies for the Intensification of Eco-sustainable Catalytic processes*
- 10:20 – 10:30 OP24 **Bucchieri Michele** (POLITO)  
*Title: Synthesis and characterization of photocatalysts enhanced by upconversion systems and/or plasmonic nanomaterials to exploit sunlight in reactions of environmental interest.*

- 10:30 – 11:05**                *Coffee Break*  
Picture at the entrance of Sala dei Notari
- 11:05 – 11:15    OP25   **Ciani Marta**                                (UNIPG/DCBB)  
*Title: Circular catalytic processes of the valorization of waste and the production of hydrogen from LOHCs*
- 11:15 – 11:25    OP26   **Garbini Mauro**                                (UNIBO)  
*Title: Development of new homo- and heterogeneous catalytic protocols for the valorization of CO<sub>2</sub>*
- 11:25 – 11:35    OP27   **Stocchetti Sara**                                (UNICA)  
*Title: From biomass to catalysis. An integrated platform for the development of new catalysts and their application in the synthesis of biobased monomers and polymers.*
- 11:35 – 11:45    OP28   **Urma Madan Mohan**                                (UNISS)  
*Title: Development of new photocatalysts based on earth-abundant metals and their applications in sustainable organic methodologies*
- 11:45 – 11:55    OP29   **Maristella Simone**                                (UNIBA)  
*Title: Merging Metal-Organic Frameworks with Deep Eutectic Solvents for the Development of Sustainable Technologies in Metal Catalysis*
- 11:55 – 12:00                Closing Ceremony
- 12:00 -                Collegio dei docenti



December 18<sup>th</sup>-19<sup>th</sup>, 2023

Palazzo dei Priori – *Sala dei Notari*

Perugia

1<sup>st</sup> workshop



**PhD Coordinator:** Prof. Luigi Vaccaro  
*University of Perugia, Italy*

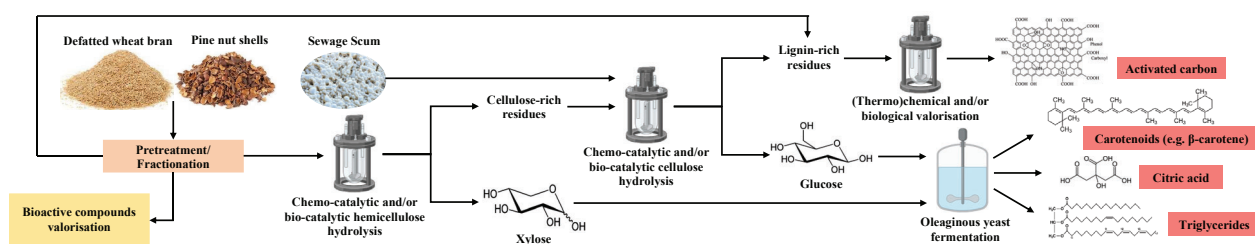
**Abstract of the Oral Presentations**

**Nelly Morrone**

*University of Pisa, Department of Chemistry and Industrial Chemistry, GreenCat Research Group*

**Holistic development of chemical and biological catalysis approaches for the conversion of waste renewable resources into high value-added molecules**

**Supervisors:** Prof. Anna Maria Raspolli Galletti, Prof. Claudia Antonetti, Dr. Nicola Di Fidio



### Thesis abstract:

The intensive exploitation of fossil raw materials to produce fuels and building blocks of current industrial production has determined several critical issues. Biomass represents a promising alternative to fossil sources and biorefineries assume a central role, leading to the conversion of biomass into chemicals, intermediates, materials and fuels. Third-generation biomasses and wastes, mainly composed of cellulose, hemicellulose, lignin and bioactive compounds, can be converted into valuable bio-products and bio-fuels. The exploitation of each fraction of the feedstock is fundamental to increase the sustainability. Since cellulose, hemicellulose, lignin and exctratives require specific reaction conditions for their conversion into bio-products and bio-fuels, the cascade multi-step approach could ensure the highest valorisation of each biomass component.

The main purpose of this research project is to design, investigate and optimise the conversion of different wastes, such as defatted wheat bran, pine nut shells and sewage scum to triglycerides, citric acid and carotenoids through an innovative approach based on the synergistic combination of chemical and biological catalysis.

Firstly, the chemical characterisation of each biomass will be carried out. Tailored pretreatment and/or fractionation approaches will be investigated to extract bioactive compounds for subsequent exploitation. Chemical and enzymatic catalysis will be optimised to valorise both polisaccarides and lignin. Homogeneous acids and cellulolytic mixtures will be evaluated for the hydrolysis reaction. The main reaction parameters will be optimised by a chemometric approach. The obtained hydrolysates will be used as a substrate for the fermentation of oleaginous microorganisms to produce target molecules and the process parameters will be optimised. Lignin-rich residues collected after the pretreatment or the hydrolysis will be valorised through the synthesis of aromatics, activated carbons, resins or functionalised materials by implementing (thermo)chemical or biological approaches. The project involves the implementation of LCA studies to evaluate the environmental and economic sustainability of the optimised processes.