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| **Title** | **Development of New Enantioselective Transformations and Application to Asymmetric Synthesis** |
| **PI** | **ORLANDI Manuel** |
| **Research Group** | **Molecular Recognition and Catalysis** |
| **Curriculum** | **Scienze Chimiche** |
| **Contact** | **email:** | **manuel.orlandi@unipd.it** |

**Project description:**

Asymmetric reactions that rely on chiral transition metal catalysts are powerful synthetic tools for the synthesis of complex molecular targets. Over the past decades, precious metals such as Pd, Rh, and Ir have dominated the field due to their efficiency. However, the increasing cost and limited availability of these metals have created a need for the development of new catalysts based on more abundant and accessible first-row transition metals, such as Fe, Ni, Cu, and Co.

Our group develops novel transition metal catalysts and transformations to enable new enantioselective reactivity with Cu[1] and Co.[2] Particular attention is given to C–C bond-forming cross-couplings, C=C bond reductions,[3] and hydrofunctionalizations,[4] which will be explored in the synthesis of complex targets, including natural product fragments and pharmaceuticals.

Additionally, our work focuses on studying the mechanisms of the transformations we develop and understanding the factors that influence the reaction enantioselectivity. To this end, we employ both classical and modern tools, including kinetic analysis, linear free energy relationships, isotope labeling, DFT calculations, and multivariate correlation analysis.[5]

**Hosting group(s) for the period abroad** (tentative list based on previous or ongoing agreements): Prof. David Sarlah (Rice University, TX, USA), Prof. Daniele Leonori (RWTH, GER), Prof. Allegra Franchino (Durham University, UK), or Prof. Fabio Romiti (University of Texas at Dallas, TX, USA).

[1] Escudero-Casao, M.; Licini, G.; Orlandi, M. *J. Am. Chem. Soc*. **2021**, *143*, 3289.

[2] Pugliese, G., Vaghi, F., Lonardi, G., Licini, G., Orlandi, M., *Eur. J. Org. Chem*. **2023**, e202201492.

[3] Lonardi, G., Parolin, R., Licini, G., Orlandi, M., *Angew. Chem. Int. Ed*. **2023**, e202216649.

[4] Lonardi, G.; Franco, S.; Sartorello, M.; De Faveri, C.; Stivanello, M.; Licini, G.; Orlandi, M. *ACS Catal.* **2024**, *14*, 8730.

[5] Orlandi, M.; Hilton, M. J.; Yamamoto, E.; Toste, F. D.; Sigman, M. S. *J. Am. Chem. Soc*. **2017**, *139*, 12688.