Title	**Producing and engineering enzymes for biocatalysis and bioremediation**
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Projects description:

The proposed **research activity**, focused on the study of enzymes, targets the specific fields of biocatalysis or bioremediation and will predictably proceed through the following step: (i) *in silico* identification and recombinant production of new enzymes; (ii) their biochemical and structural characterization (crystallization or modeling); (iii) bioinformatics analysis and engineering of the proteins (site-specific mutagenesis / rational design / directed evolution).

Chemical industry is increasingly interested in **biocatalysis** to assist synthesis of molecules with high added value. Enzymes can help in overcoming critical steps in organic synthesis by furnishing high chemo-, regio- and enantio-specificity and selectivity. The widespread application of biocatalysts has however to face the limited number of simultaneously synthetically useful and commercially available enzymes. Basic research is needed to uncover new enzymes and to improve their stability and substrate repertoire, as well as their capability of withstanding the harsh conditions often required in industrial reactors (non-aqueous solvents or extreme salinity, temperature, pH).

Pollution of freshwater by PFASs (Perfluoroalkyl Substances) is currently an emergence in Veneto. A possible approach for **bioremediation** consists in finding one or more enzymes (laccases, peroxidases and fluoroacetate dehalogenases) that can be used to remove PFAS or reduce their toxicity, after their expression in a microbial strain (such as the cyanobacterium *Synechocystis*) proven to be cultivated in real wastewaters.

Publications:

- Haudecoeur R, Carotti M, Gouron A, Maresca M, Buitrago E, Hardré R, Bergantino E, Jamet H, Belle C, Réglier M, Bubacco L, Boumendjel A (2017) 2-hydroxypyridine-N-oxide-embedded aurones as potent human tyrosinase inhibitors. ACS Med. Chem. Lett. 8: 55–60
- Fogal S, Beneventi E, Cendron L, Bergantino E (2015) Structural basis for double cofactor specificity in a new formate dehydrogenase from the acidobacterium Granulicella mallensis MP5ACTX8. Appl Microbiol Biotechnol, 99: 9541-54
- Beneventi E, Niero M, Motterle R, Fraaije M, Bergantino E (2013). Discovery of Baeyer-Villiger monooxygenases from photosynthetic eukaryotes. J Mol Calalysis B-Enzymatic, 98: 145-154

Collaborations/Network:

- Bruno Miroux, Laboratory of Physical and Chemical Biology of Membrane Proteins UMR 7099, Institute of Physico-Chemical Biology, Paris, France - University Paris Diderot;
- Marco Fraaije, Molecular Enzymology Group, University of Groningen, Groningen, The Netherlands;
- Melanie Hall, Department of Chemistry, University of Graz, Austria.

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