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Title of the project

EnvELOP: Environmental tuning of microbial rhodopsins Electronic
Landscape for New Optogenetic Potentialities

Scientific Investigator

Guido Ciro Achille

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UNIVERSITA' DEL PIEMONTE ORIENTALE
Via Duomo 6, Vercelli (VC) – 13100

Abstract

The EnvELOP project aims to improve optogenetic tools based on microbial rhodopsins (mRhs), light-sensitive proteins used to control cellular activity. Despite their potential, current mRh-based devices face limitations due to an incomplete understanding of how structural features affect their function. EnvELOP focuses on the role of the hydrogen bonding network (HBN) in the chromophore binding cavity, a key but underexplored factor in light activation. Using advanced computational methods, the project will study how changes in HBN and protein environment influence photochemical properties such as absorption wavelength and excited state lifetime. By simulating and comparing wild-type and mutant mRhs, EnvELOP aims to clarify structure-function relationships and support the rational design of more effective optogenetic tools.