

DOTTORATO DI RICERCA IN BIOLOGIA CELLULARE E DELLO SVILUPPO

Proposta di progetto per una borsa Dottorato Sapienza

Research title/Titolo della ricerca:

Yeast response to environmental factors: metabolism and regulation/Risposta del lievito ai fattori ambientali: metabolismo e regolazione

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Summary

The research line aims to study the response to environmental signals in the biotechnological yeast *Kluyveromyces lactis* (low oxygen, high carbon dioxide, light/dark exposure). In detail, the role of key carbon dioxide metabolic enzymes will be investigated, such as Carbonic Anhydrase, Acetyl-CoA Carboxylase and Pyruvate Carboxylase, especially by studying elements involved in transcription regulation. Among transcription regulators, *KIMga2* will be considered in the research because of its involvement in the response to environmental stress, in maintenance of cell fitness and in lipid biosynthesis. Studies on *KIMGA2* will allow to connect lipid metabolism with hypoxia, which is essential in studies of cellular adaptation to environmental changes. Carbonic Anhydrase studies will be fundamental for studies and biotechnological applications involving CO₂ fixation from atmosphere.

Lavori pubblicati negli ultimi 5 anni dal docente richiedente la borsa:

1. De Angelis L., Rinaldi T., Cirigliano A., Bello C., Reverberi M., Amaretti A., Montanari A., Santomartino R., Raimondi S., Gonzalez A. and **Bianchi M.M.** "Functional roles of the fatty acid desaturases encoded by *KIOLE1*, *FAD2* and *FAD3* in the yeast *Kluyveromyces lactis*" *MICROBIOLOGY* (doi: 10.1099/mic.0.000315)**162**, 1435-45 (2016).
2. Stirpe M., Palermo V., **Bianchi M.M.**, Silvestri R., Falcone C., Tenore G., Novellino E. and Mazzoni C. "Annurca apple (*M. pumila* Miller cv Annurca) extracts act against stress and ageing in *S. cerevisiae* yeast cells" *BMC COMPLEMENT. ALTERN. MED.* (doi: 10.1186/s12906-017-1666-7) **17**, 200 (2017).
3. Santomartino R., Riego-Ruiz L. and **Bianchi M.M.** "Three, two, one yeast fatty acid desaturases: regulation and function" *WORLD J. MICROBIOL. BIOTECHNOL.* (doi: 10.1007/s11274-017-2257-y) **33**, 89 (2017).
4. Cirigliano A., Macone A., **Bianchi M.M.**, Oliaro-Bosso S., Balliano G., Negri R. and Rinaldi T. "Ergosterol reduction impairs mitochondrial DNA maintenance in *S. cerevisiae*" *BIOCHIM. BIOPHYS. ACTA Mol. Cell Biol. Lipids* (doi: 10.1016/j.bbailip.2018.12.002) **1864**, 290-303 (2019).
5. Santomartino R., Camponeschi I., Polo G., Immesi A., Rinaldi T., Mazzoni C., Brambilla L. and **Bianchi M.M.** "The hypoxic transcription factor *KIMga2* mediates the response to oxidative stress and influences longevity in the yeast *Kluyveromyces lactis*" *FEMS YEAST RES.* **19**, foz020 (doi: 10.1093/femsyr/foz020) (2019).
6. Santomartino R., Ottaviano D., Camponeschi I., Alcarpio Landicho T.A., Falato L., Visca A., Soulard A., Lemaire M. and **Bianchi M.M.** "The hypoxic expression of the glucose transporter *RAG1* reveals the role of the bHLH transcription factor Sck1 as a novel

- hypoxic modulator in *Kluyveromyces lactis*" FEMS YEAST RES. **19**, foz041 (doi: 10.1093/femsyr/foz041) (2019).
7. Cirigliano A., Amelina A., Biferali B., Macone A., Mozzetta C., **Bianchi M.M.**, Mori M., Botta B., Pick E., Negri R. and Rinaldi T. "Statins interfere with the attachment of *S. cerevisiae* mtDNA to the inner mitochondrial membrane" J. ENZYME INHIB. MED. CHEM. (doi: 10.1080/14756366.2019.1687461) **35**, 129-137 (2020).
 8. Camponeschi I., Damasco A., Uversky V.N., Giuliani A. and **Bianchi M.M.** "Phenotypic suppression caused by resonance with light-dark cycles indicate the presence of a 24-hours oscillator in yeast and suggests a new role of intrinsically disordered protein regions as internal mediators" J. BIOMOL. STRUCTURE & DYNAMICS. (doi:10.1080/07391102.2020.1749133) (2020).
 9. Aguirre-López B., Escalera-Fanjul X., Hersch-González J., Rojas-Ortega E., El-Hafidi M., Lezama M., González J., **Bianchi M.M.**, López G., Márquez D., Scazzocchio C., Riego-Ruiz L. and González A. "In *Kluyveromyces lactis* a pair of paralogous isozymes catalyze the first committed step of leucine biosynthesis in either the mitochondria or the cytosol" FRONT. MICROBIOL. (doi: 10.3389/FMICB.2020.01843) **11**: 1843 (2020).

References (other citations, if appropriate)

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4. Camattari A. et al. (2007) "Induction by hypoxia of heterologous protein production with the KIPDC1 promoter in yeasts" Appl. Environ. Microbiol. (0099-2240) **73**, 922-929.
5. Micolonghi C. et al. (2011) "The Rag4 glucose sensor is involved in the hypoxic induction of PDC1 gene expression in the yeast *Kluyveromyces lactis*" Eukariot. Cell (1535-9778) **10**, 146-148.
6. Micolonghi C. et al. (2012) "A dual signaling pathway for the hypoxic expression of lipid genes, dependent on the glucose sensor Rag4, is revealed by the analysis of KIMGA2 gene in *Kluyveromyces lactis*" Microbiology (1350-0872) **158**, 1734-1744.
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