DOTTORATO DI RICERCA IN BIOLOGIA CELLULARE E DELLO SVILUPPO

41 CYCLE
Project proposal for a Sapienza PhD scholarship

Other research line

Title: Effect of temperature variation and pollution on transposable elements and genomic stability in *Danio rerio*.

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Summary (max 500 words)
Human activities strongly alter natural environment through the emission of chemical substances that pollute the soil and the waters or contribute to global warming. Growing scientific evidence suggests that environmental stressors can influence the expression and activity of transposable elements (TEs) and that heat shock proteins (HSP) participate in these processes. TEs are repetitive DNA sequences capable of moving from one location to another within the genome. TE activity is mutagenic in humans and other organisms, and, for this reason, it may stimulate the emergence of new phenotypes better adapted to the modified environments thus acting as driving force at the evolutionary level. The effects of TE activation are known in *Drosophila melanogaster* exposed to high temperatures and similar effects are reported in *Danio rerio* at low temperature, while information on the majority of non-model organisms, including molluscs, is lacking. We will investigate the effects of temperature variation and other environmental stressors to which organisms may be exposed in the natural environment on TE expression and mobility in teleosts (*Danio rerio*). The choice of non-homeothermic animals allows to study the effect of environmental thermal variations at cellular level. Results will provide insights on how environmental stressors act as an evolutionary force triggering genetic variability and adaptation. In the current context of global warming, our results will inform the resilience of species to rising temperatures and the possibility of implementing preventive actions. In a long-term perspective, this research will also provide useful information regarding human health since there are drugs capable of blocking the actions of TEs.

Pertinent Publications of the proponent (last 5 years)

Maffioli E, Nonnis S, Grassi Scalvini F, Grana J, Negri A, Frabetti F, Tedeschi G, **Toni M**. Chronic environmental temperature affects protein expression in the eye of adult zebrafish

(Danio rerio). Sci Rep. 2025 Nov 29;16(1):392. doi: 10.1038/s41598-025-29745-1. PMID: 41318778; PMCID: PMC12770568.

Bonaccorsi di Patti MC, Meoni M, **Toni M**. Comparative Analysis of Aggregation of β- and γ-Synucleins in Vertebrates. Biomolecules. 2025 Aug 26;15(9):1231. doi: 10.3390/biom15091231. PMID: 41008538; PMCID: PMC12467708.

Toni M, Frabetti F, Tedeschi G, Alleva E. Effects of Environmental Temperature Variation on the Spatio-Temporal Shoaling Behaviour of Adult Zebrafish (*Danio rerio*): A Two- and Three-Dimensional Analysis. Animals (Basel). 2025 Jul 8;15(14):2006. doi: 10.3390/ani15142006. PMID: 40723469; PMCID: PMC12291765.

Maffioli E, Nonnis S, Negri A, Fontana M, Frabetti F, Rossi AR, Tedeschi G, **Toni M**. Environmental Temperature Variation Affects Brain Lipid Composition in Adult Zebrafish (*Danio rerio*). Int J Mol Sci. 2024 Sep 5;25(17):9629. doi: 10.3390/ijms25179629. PMID: 39273578; PMCID: PMC11394874.

Maffioli E, Nonnis S, Grassi Scalvini F, Negri A, Tedeschi G, **Toni M**. The Neurotoxic Effect of Environmental Temperature Variation in Adult Zebrafish (*Danio rerio*). Int J Mol Sci. 2023 Oct 29;24(21):15735. doi: 10.3390/ijms242115735. PMID: 37958719; PMCID: PMC10648238.

Bonaccorsi di Patti MC, Angiulli E, Casini A, Vaccaro R, Cioni C, **Toni M**. Synuclein Analysis in Adult *Xenopus laevis*. Int J Mol Sci. 2022 May 27;23(11):6058. doi: 10.3390/ijms23116058. PMID: 35682736; PMCID: PMC9181771.

Maffioli E, Angiulli E, Nonnis S, Grassi Scalvini F, Negri A, Tedeschi G, Arisi I, Frabetti F, D'Aniello S, Alleva E, Cioni C, **Toni M**. Brain Proteome and Behavioural Analysis in Wild Type, $BDNF^{+/-}$ and $BDNF^{-/-}$ Adult Zebrafish (*Danio rerio*) Exposed to Two Different Temperatures. Int J Mol Sci. 2022 May 17;23(10):5606. doi: 10.3390/ijms23105606. PMID: 35628418; PMCID: PMC9146406.

D'Agostino Y, Frigato E, Noviello TMR, **Toni M**, Frabetti F, Cigliano L, Ceccarelli M, Sordino P, Cerulo L, Bertolucci C, D'Aniello S. Loss of circadian rhythmicity in *bdnf* knockout zebrafish larvae. iScience. 2022 Mar 11;25(4):104054. doi: 10.1016/j.isci.2022.104054. PMID: 35345456; PMCID: PMC8957028.

Fasano G, Godoy RS, Angiulli E, Consalvo A, Franco C, Mancini M, Santucci D, Alleva E, Ciavardelli D, **Toni M**, Biffali E, Ekker M, Canzoniero LMT, Sordino P. Effects of low-dose methylcyclopentadienyl manganese tricarbonyl-derived manganese on the development of diencephalic dopaminergic neurons in zebrafish. Environ Pollut. 2021 Oct 15;287:117151. doi: 10.1016/j.envpol.2021.117151. Epub 2021 Apr 23. PMID: 34020261.

Nonnis S, Angiulli E, Maffioli E, Frabetti F, Negri A, Cioni C, Alleva E, Romeo V, Tedeschi G, **Toni M**. Acute environmental temperature variation affects brain protein expression, anxiety and explorative behaviour in adult zebrafish. Sci Rep. 2021 Jan 28;11(1):2521. doi: 10.1038/s41598-021-81804-5. PMID: 33510219; PMCID: PMC7843641.

Nonnis S, Angiulli E, Maffioli E, Frabetti F, Negri A, Cioni C, Alleva E, Romeo V, Tedeschi G, **Toni M**. Acute environmental temperature variation affects brain protein expression, anxiety and explorative behaviour in adult zebrafish. Sci Rep. 2021 Jan 28;11(1):2521. doi: 10.1038/s41598-021-81804-5. PMID: 33510219; PMCID: PMC7843641.