Evolutionary molecular mechanisms of cell death and differentiation ruling the effects of benthic diatoms on a marine decapod crustacean (DEANOMS)

Director of Studies **Dr. Valerio Zupo, SZN**
Supervisors **Dr. Maria Costantini, SZN**
Prof. Robert Hoehndorf, King Abdullah University of Science and Technology Department of Ecosustainable Marine Biotechnology

Department of Ecosustainable Marine Biotechnology

Seat: Ischia (NA) and Naples, Italy

Project Summary

Life on the earth is fundamentally shaped by cell death and differentiation processes. This evidence boosted research efforts in the last decades to identify methods, mechanisms and forms of cell death. Initially, cell death was linked to apoptosis, but it has been clearly shown, more recently, that various mechanisms may explain the unsolved phenomena. Since cell death and differentiation may contribute a number of biotechnological applications, several researches were aimed at defining the molecular mechanisms priming the specificity of cell death after the initial signaling and start of the process. A marine shrimp, *Hippolyte inermis*, was demonstrated to be a valid model to investigate these phenomena, because it contains an androgenic gland (AG) that is selectively destroyed by the ingestion of benthic diatoms of the genus *Cocconeis*. The destruction of the gland induces a protandric change of sex, and consequently, the effect of the diatoms may be easily followed by checking the sex ratios in small experimental pools of the shrimps, as well as in natural populations. Recent investigations produced the transcriptome analysis of shrimps when fed or non-fed on diatoms, demonstrating that diatoms ingested in the first days of development trigger, as soon as after 5 days of post-larval development, a dramatic change in the physiology of the shrimp and a prompt destruction of the AG. The initial mechanism of action of the diatom was hypothesized to be through ferroptosis, followed by apoptosis of the testis and consequent sex shift. Here we aim at proceeding further in the identification of the mechanism of action, to test previous hypotheses and detect the factors that elicit such a specific cell-death activity, selectively influencing the AG tissues and acting only in the first days of post-larval development. Why a lipophilic compound is active only during a short time window and only on stem cells of the AG? Is this mechanism similar to the one already demonstrated in other common models (e.g., *Caenorabditis elegans*)? Which genes are involved in time sequence? How these mechanisms could be transferred to other populations of cells to control, for example, the expansion of tumor cells or to avoid the apoptotic destruction of nerve cells? All these aspects will be afforded through highly multi-disciplinary research, involving ecological approaches along with molecular and bioinformatic analyses to reach cutting-edge applications in various biotechnological fields and to obtain key information on fundamental biology issues.