Evolution of respiratory adaptations in hydrothermal vent scale worms (Polynoidae)

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Polynoidea is a very diverse family at hydrothermal vents (up to 10 species at a given vent site) and occupies all microenvironments that harbor metazoa, from the coldest (2°C and relatively well oxygenated), to the warmest (ca. 40°C and markedly hypoxic). Respiratory adaptations must have taken place in the evolutionary history in order for this group to survive and succeed in such challenging environments. In addition to the presence of gills in some species, vent species of this family exhibit a pink-to-red colored coelomic fluid that to date, at least in Branchipolynoe, is known to be due to the presence of two forms of extracelular multidomain hemoglobins. Some species only possess monodomain globins but in the Branchipolynoe lineage, we can find tetradomain hemoglobins. The latter were most probably formed by tandem duplication, one domain at a time. The fact that they are multidomain is unique among the annelids, and interestingly, the globin sequences, when compared with others, cluster with intracellular globins and not the extracellular ones, making this a remarkable result. This suggests that the hemoglobin that is found in the coelomic cavity of the vent Polynoidae arose from an intracellular globin in the lineage that colonized the vents.

Despite adaptations to better extract the oxygen from the hypoxic environment, the species most likely also have to rely on anaerobic metabolism, not only because hydrothermal environments presents a highly variable oxygen concentration, but also because the presence of sulfide can inhibit aerobic metabolism. Keeping this in mind we are carrying out a survey of genes encoding proteins involved in anaerobiose.

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