Developing vertebrate embryos are exposed to a wide variety of environments, be it in the water, in a shell or in the womb. Increasing evidence shows that these environments include microbial communities and that vertebrates are exposed to a microbiome during development. However, despite this increasing body of evidence, there is little research to determine whether microbiota communities affect the normal development of the embryo and in particular, the development of the nervous system. It is important to understand this as we know that the microbiome influences nervous system function in juveniles and adults and has significant impact in neurodegenerative diseases of old age. The lack of research at embryonic stages is in part due to the difficulties and costs of creating axenic or germ-free (GF) embryos. We have developed a germ-free zebrafish embryo and larvae model that allows us to test the role of the microbiome in the development and have preliminary evidence that the sensory nervous system is impacted.

The aim of this project is to identify the roles that the microbiome plays in development using the zebrafish model. We will identify changes in nervous system development in germ-free zebrafish embryos and also investigate any behavioural changes that occur. We will identify the molecular mechanisms underlying these changes and investigate if modulating the microbiome will alter the phenotypes of zebrafish models of neurodevelopmental disorders. This work will be significant as it will opening up new avenues for the understanding of how nervous system architecture is established and how it can be influenced by the environment. It will also lead to further work investigating the impact of the microbiome in other developing systems in both the zebrafish and other vertebrates, including mammals and may lead to new methods for manipulating the outgrowth of neurons.