Internship Proposal

Proposal By: Sónia Rocha | soniar@i3s.up.pt

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Contact: soniar@i3s.up.pt

Project Title:
Investigating Intraflagellar Transport Mechanisms Using Caenorhabditis elegans
Level:

Master Student

Project Summary:

Cilia are highly conserved organelles that extend from the cell surface and are essential for numerous cellular processes, including sensory perception, motility, signaling, cell division, differentiation, and intercellular communication. Defects in ciliary structure or function are associated with a group of disorders known as ciliopathies. Examples include Bardet-Biedl syndrome and Meckel-Gruber syndrome, which currently lack effective therapeutic strategies.

Cilia assembly and function rely on intraflagellar transport (IFT), a bidirectional transport system that moves ciliary cargo using large protein complexes called IFT trains. These trains are composed of IFT-B and IFT-A subunits and are transported by opposing molecular motors. Anterograde transport, from the ciliary base to the tip, is driven by kinesin-2 motors, while retrograde transport, returning cargo from the tip to the base, is powered by dynein-2 motors. IFT is fundamental for the formation and maintenance of all cilium types.

Despite the critical role of cilia, many aspects of their assembly and function remain poorly understood. The nematode Caenorhabditis elegans serves as an excellent model organism for studying cilia due to its genetic tractability, well-characterized ciliary structures, and conserved IFT machinery. In this study, C. elegans will be used to investigate the mechanisms of IFT transport, providing new insights into the regulation of ciliary dynamics and its implications for ciliopathies.

Work to be developed by the student:

The project will involve the use of C. elegans mutants generated via CRISPR/Cas9, including fluorophore-tagged knock-in strains of Dynein-2 and IFT subunits, to enable optimized high-

resolution live imaging of IFT. Additionally, molecular biology techniques such as PCR will be employed to track and verify mutations. Dye-filling assays to assess cilia integrity will also be performed.

References:

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DE INVESTIGAÇÃO
E INOVAÇÃO
EM SAÚDE
UNIVERSIDADE
DO PORTO

Rua Alfredo Allen, 208
4200-135 Porto
Portugal
+351 220 408 800
info@i3s.up.pt
www.i3s.up.pt