TITRE : Physical control of bilateral organ size during development in *Drosophila.*

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Ce stage peut être poursuivi en thèse : OUI

Si oui, la thèse est-elle financée : NON

SUJET du stage :

How bilateral organs regulate growth during development to achieve identical final size is an enduring mystery of biology. In wild-type *Drosophila*, adult left and right wing areas rarely differ by more than 1%. Whether this precision stems from continuous feedback during development or developmental checkpoint, it requires that organs can measure their size and modulate their growth appropriately. How this is achieved is currently unclear.

Life on earth has evolved under a constant gravity, which possibly acts as a primary reference in the development of an organism's body plan. We (Roshan Vijendravarma, in Pierre Leopold's lab at Institut Curie) have recently discovered that perturbing graviperception of *Drosophila* during larval development by rearing them in microgravity simulators led to a major (eight fold) increase of the typical disparity between left and right wing size of adult flies. This shows that perception of gravity during development is essential to eliminate intra-individual wing size variation, and it suggests that animals could utilize gravity for regulating their organ sizes with high precision.

In the specific case of the fly wing size, our working hypothesis is that wing size symmetry could be achieved through a regulatory mechanism relying on physical forces and involving gravity. We hypothesize that the growth rates of the larval wing imaginal discs (the precursors of the adult wings) are controlled by the influx of oxygen through the tracheal system, whose morphology depends on the gravitational load exerted by the two discs, and hence on their size. The goal of this internship will be to propose a theoretically formulation of this hypothesis; to evaluate the feasibility of such regulatory mechanism; and to postulate empirically testable predictions.

The methodology used for the physical model will combine several theoretical approaches: the theory of transport phenomena - to calculate the O_2 density and fluxes in the complex tracheal morphology; the theory of elasticity of tissues - to account for the effect of the wing disc's weight on the tracheal network, and the theory of dynamical systems - to study the coupled growth of the two wing discs competing for oxygen influx. This internship is part of a interdisciplinary collaboration funded by the Q-Life Institute (https://www.psl.eu/en/q-life-institute) and will involve constant crosstalk with the experimental team.