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From cell mechanics to tissue-scale properties properties in development

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The developmental process implies precise but significant changes in the geometry and structure of the embryonic tissues. Recent results show that apparently minor changes in the mechanical properties at the cellular level trigger deep, non-linear transitions in the topological organization of the whole embryonic tissue. In consequence, the tissue changes its material properties abruptly, enabling or preventing geometrical deformations. Open questions remain, like the potential existence of causal feedbacks between cell differentiation processes and the potential heterogeneity of topological patterns existing within the tissue. The results presented in this talk are based on the fundamental assumption that predictive frameworks in theoretical biology must explore the connection between different scales of the system. In this particular case, we use topology to establish a bridge between the system's scales defined by i) the cell level and ii) the cell collective/tissue level. Establishing this connection enables us to predict global, non-trivial behaviours in tissues from the empirically feasible observables related to the mechanical properties of single cells.

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