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# Cells structured population dynamics : application to the morphogenesis of ovarian follicles

Frédérique Robin\*<sup>1</sup>

<sup>1</sup>Team-Project M3Disim, INRIA Saclay Ile-de-France – L’Institut National de Recherche en Informatique et en Automatique (INRIA) – France

## Résumé

In collaboration with Frédérique Clément (from Project-Team M3Disim, INRIA Saclay Ile-de-France) and Romain Yvinec (Team BIOS, INRA Centre Val de Loire).

We present a multi-type age dependent model in both a deterministic and stochastic framework dedicated to the study of the basal development of ovarian follicles. Inspired by the model introduced recently in [1], we derive a linear age-structured version that represents the changes in the population of follicular cells distributed into successive layers surrounding the oocyte. Studying the large-time behavior, we derive explicit analytical formulas characterizing an exponential growth of the population (Malthus parameter, asymptotic cell number moments and stable age distribution). Then, we compare the theoretical and numerical outputs of our model with experimental biological data informing on the follicle morphology in the ovine species (follicle and oocyte diameters, layer number and total cell number). In the case of age independent division rates, we prove the structural parameter identifiability of our model, and estimate the parameter values to fit the cell numbers in each layer during the early stages of follicle development.

Clément F., Michel P., Monniaux D., Stiehl T., Coupled somatic cell kinetics and germ cell growth: multiscale model-based insight on ovarian follicular development, *Multiscale et Modeling & Simulation*, 11(3), 719-746, 2013.

Clément F., Robin F., Yvinec R., Analysis and calibration of a linear model for structured cell populations with unidirectional motion : Application to the morphogenesis of ovarian follicles, *Submitted*. <https://arxiv.org/abs/1712.05372>

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\*Intervenant