



IMMO

EXPLORATORY PROJECT

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Coordination

Violette Thermes

LPGP

violette.thermes@inrae.fr

Romain Yvinec

UMR PRC

romain.yvinec@inrae.fr

Key words

Fertility

Oogenesis

3D imaging

Deep learning

Structured population dynamics

INRAE units involved

LPGP

PRC

Partnerships

Inria

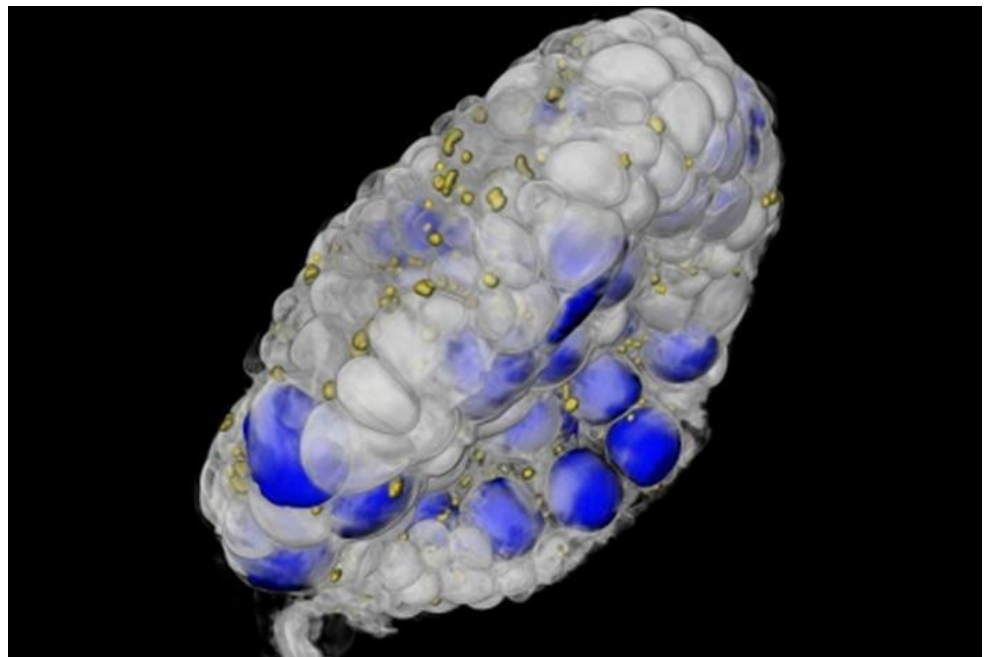
Visualising fish oocytes using AI and 3D imaging

Context and challenges

In the natural environment as well as in fish farming, the process of formation and maturation of female gametes (oogenesis) is essential for reproductive success.

In multiple-spawning fishes, oogenesis involves anatomical structures in permanent renewal, the ovarian follicles, which accompany the development of the gametes until spawning. Despite the identification of numerous regulatory mechanisms of oogenesis in model fish (e.g. medaka, zebrafish), we still have an incomplete and mainly qualitative view of this dynamic process. In particular, major questions remain unanswered:

- Is there a detectable ageing of ovarian function?
- What are the key controls on ovarian follicles at different stages of maturity and to what extent is the follicle population self-controlled?



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Goals

The IMMO project proposes to exploit new 3D imaging and Artificial Intelligence (AI) methods to visualise and enumerate the completeness of oocytes in fish ovaries at different ages, in order to comprehensively and quantitatively describe the entire population of ovarian follicles and oocytes.

These data will be used to validate a mathematical model describing follicular dynamics and their controls over the life span of the fish, which will reveal information not available from the data alone. The model simulations will reproduce the different types of disturbances affecting the proper functioning of oogenesis.

Research units involved and partnerships

INRAE scientific division	INRAE research units	Expertises
<u>Animal physiology and livestock systems</u>	<u>LPGP</u>	Reproductive biology, imaging and image analysis
	<u>PRC</u>	Mathematical analysis, intracellular signalling, pharmacology
External partners		Expertises
Inria	Équipe projet MUSCA	Mathematical modelling/ Reproductive physiology, Mathematical analysis

