Follicle Growth in a Perfused Artificial Ovary: A Novel Approach to Infertility Treatment

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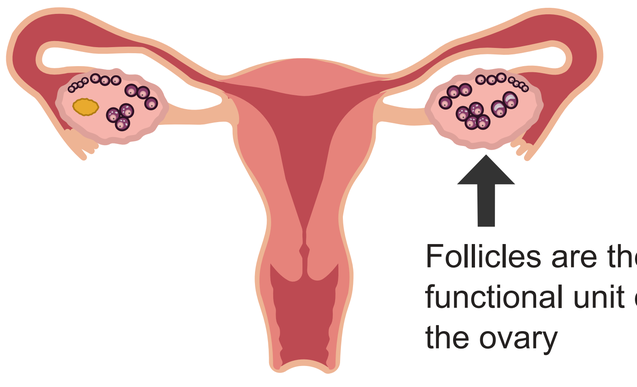
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1. Introduction

Infertility can be a significant long-term side effect of **cancer treatments** due to depletion of the ovarian follicular pool [1].

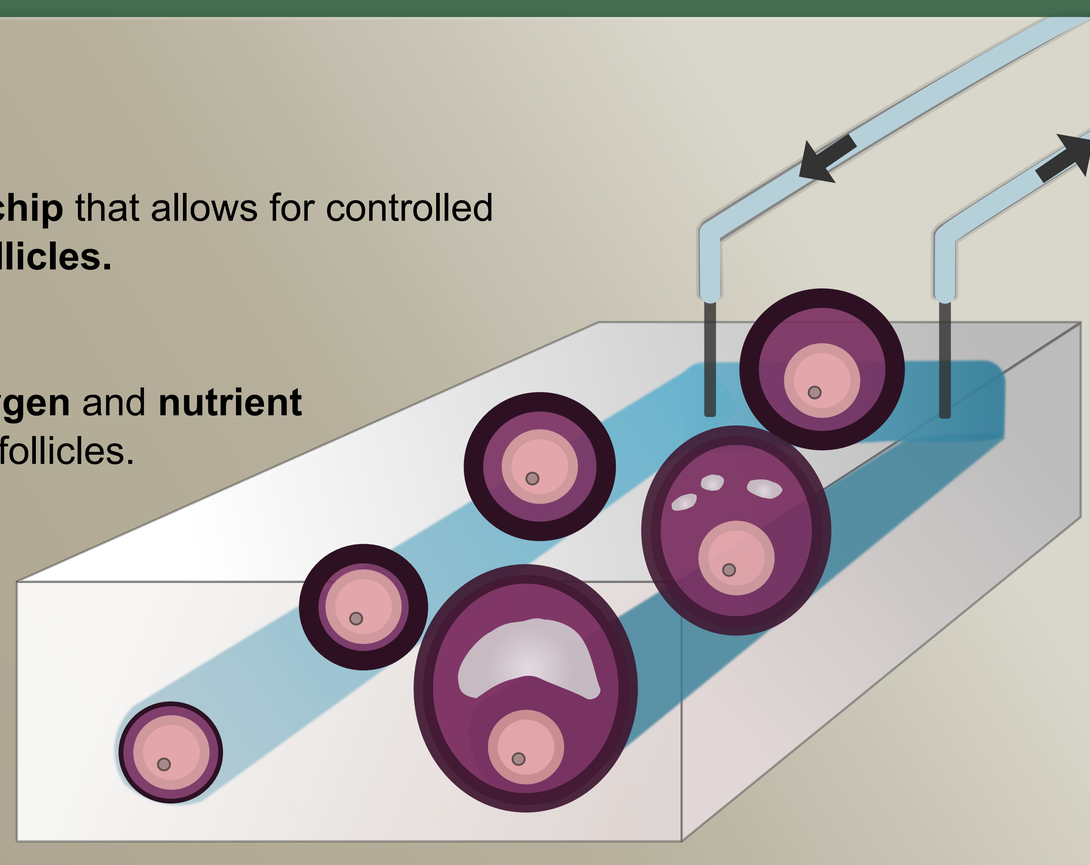
A promising approach to **fertility preservation** before treatment involves establishing in vitro follicle growth, which current cultivation methods have not yet achieved [2].



Follicles are the functional unit of the ovary

Aim of the Project

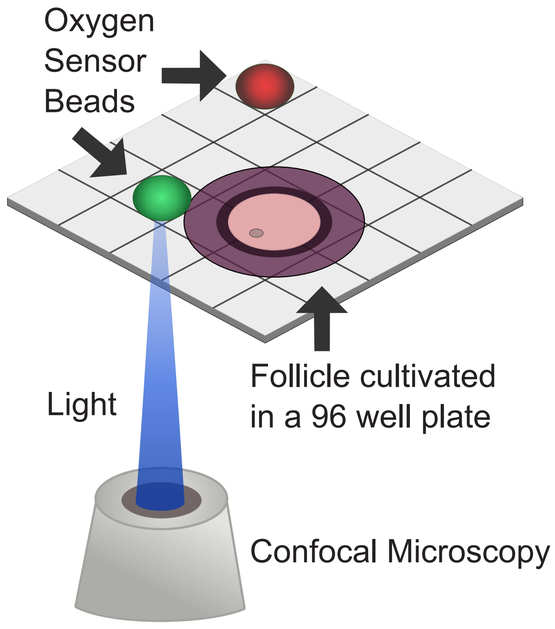
- Develop a **microfluidic chip** that allows for controlled cultivation of **multiple follicles.**
- Ensure sufficient **oxygen** and **nutrient** supply to support all follicles.

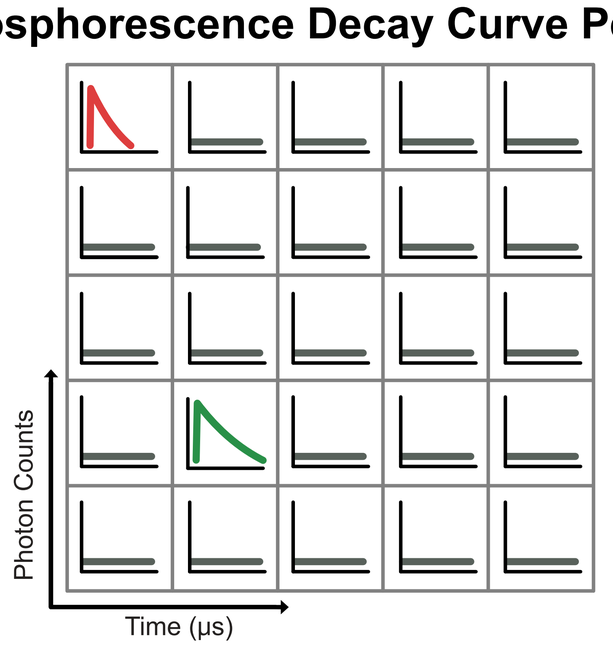


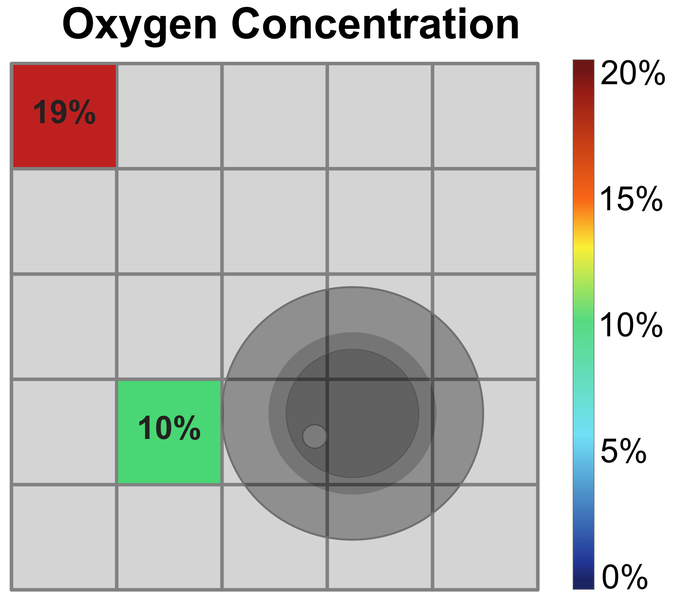
2. Method

Phosphorescence Lifetime Microscopy (**PLIM**) is used to investigate the oxygen consumption of a single follicle by measuring the **local oxygen concentration around cultivated follicles.**

This method allows for **real-time, non-invasive** monitoring of oxygen concentrations.



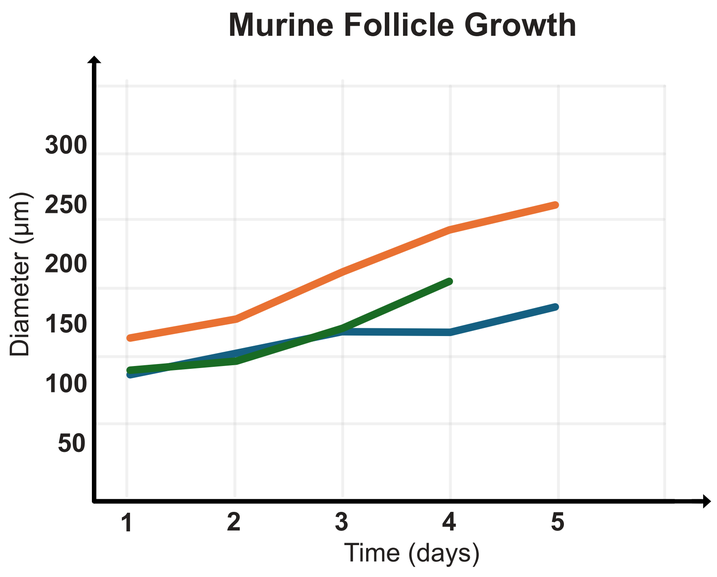


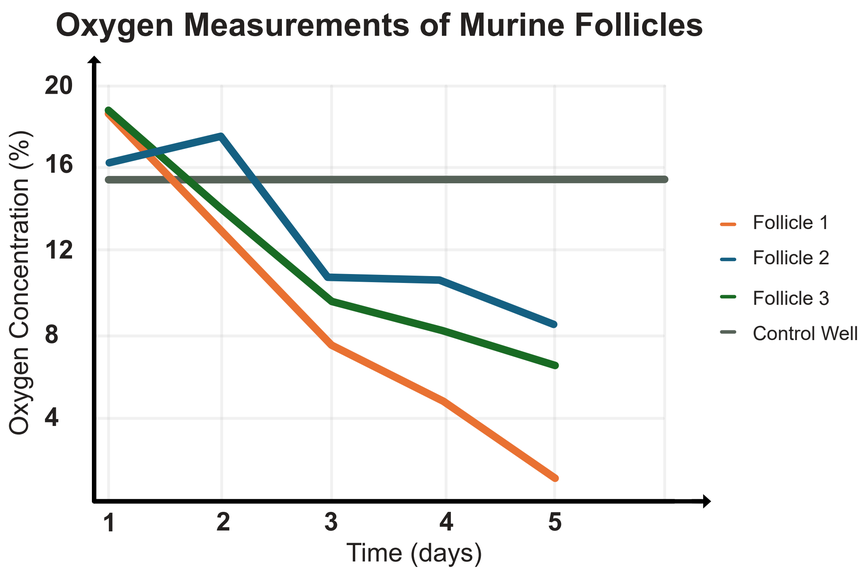


3. Results

Key findings:

- The oxygen consumption of an individual human follicle is measurable and demonstrates unexpectedly **high oxidative metabolic activity of the follicles.**



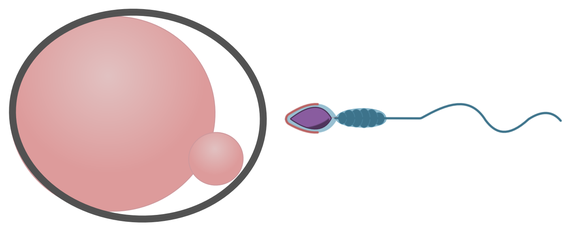


Follicles were cultured individually in ultra-low attachment (ULA) plates at 37 °C in a humidified incubator supplied with ambient air supplemented with 5% CO_2, resulting in approximately 19% O_2.

4. Conclusion

Further investigation could reveal if **hypoxic condition** is a key factor in the shortcomings of current follicle culture systems.

The perfusion model could test this hypothesis, as this system enables active oxygen transport for the follicles and may provide a solution to the follicle's notably **high oxygen consumption**.



Successful in vitro cultivation of follicles would allow **fertilization** of the resulting oocytes and thereby support more women in achieving **biological motherhood.**

[1] Xu, Min, Pamela K. Kreeger, Lonnie D. Shea, and Teresa K. Woodruff. Tissue-engineered follicles produce live, fertile offspring. *Tissue engineering* (2006).

[2] Schmidt, K. T., E. C. Larsen, C. Yding Andersen, and A. Nyboe Andersen. Risk of ovarian failure and fertility preserving methods in girls and adolescents with a malignant disease. *BJOG:An International Journal of Obstetrics & Gynaecology (*2010).

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