CNBP Chief Investigator
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Case Study

Revolutionary IVF Discoveries

THE SPARK OF LIFE

A/Prof. Jeremy Thompson

Every animal, including humans, start life as the fusion product between a sperm and egg, producing an embryo. And it is this process by which an early embryo forms and develops which continues to fascinate scientists around the world.

Some of this fascination is directed towards just how unique these two cell types are. Whereas a sperm is a mobile packet of condensed DNA, the other is the largest cell in the body (the egg, also known as the oocyte).

The uniqueness of the sperm and the oocyte, and the complexity of how they come together in the reproductive tract of any animal, is only part of the reproduction story.

Pregnancy requires an orchestrated series of hormonal events in females that entail communication between brain, gonads and in females, the reproductive tract.

Furthermore, it is not only the endocrine hormones, such as progesterone, that are important, but increasingly we recognise that reproduction involves the immune system as well. These signals culminate to provide the environment that sperm, oocytes and embryos operate within.

Studying these events present difficult challenges that are being tackled by the CNBP. Our major challenge is that we don't understand just how dynamic life is, for a sperm or egg in the reproductive tract. All of our knowledge has been gained using *in vitro* assessments.

> Our team is already seeing research success in this challenging and intriguing area.

Our photonic probe approaches are enabling us to access the lumen of the reproductive tract in a way not achievable before. We are exploring the measurement of cations such as H^+ (pH), Zn^{2+}, and Ca^{2+}, plus H_2O_2.

Both Zn^{2+} and Ca^{2+} are involved in the fertilisation process—but never visualised in the reproductive tract.

Combinations of hyperspectral autofluorescence functionality or Raman spectroscopy and Optical Coherence Tomography (OCT) imaging are also accompanying our photonic probes approach.

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Recently reported was the development of our new fibre-optic sensor that can measure H_2O_2 and pH in solution, potentially aiding the tricky process of monitoring early-stage embryos during the IVF process.