

Contribution ID: 126

Type: **Oral Presentation**

Oocyte fertilisation, chemical signalling and waves

Tuesday, 10 July 2018 12:00 (30 minutes)

It has been known for some decades that fertilisation of some amphibian and fish eggs is followed by a wave of calcium ions over the surface of the egg, which is associated with a physical change to the surface. Similar waves are seen at other stages of embryonic development. An unfertilized mammalian egg is surrounded by cumulus cells to form a cumulus-oocyte complex (COC). Just a few years ago, medical researchers at the University of Adelaide identified, for the first time, a wave-like behaviour of the cumulus cells in COCs after sperm had been added to the culture medium, believed to be a response to fertilisation. From the speed of the wave it was inferred that the cells were responding to one or more chemical signals from locations on the surface of the egg and that calcium ion concentration was the likely signal. More recently it has been determined that the wave is associated with cumulus-cell death.

I will describe some ongoing modelling and experimental work being undertaken to explain the behaviour of the cumulus cells, assuming the wave is initiated at the fertilisation site. We will examine whether a chemical release by either or both of the oocyte and cumulus cells is qualitatively consistent with experimental observations.

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Session Classification: How mixing generates spatial gradients significant to signalling, waste removal, and the distribution of microorganisms

Track Classification: Minisymposium: How mixing generates spatial gradients significant to signalling, waste removal and the distribution of microorganisms