Visions: The Art of Science

When sperm meets egg: the spark of new life†

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Activation following fertilization reawakens the quiescent egg and inhibits polyspermy. Oscillating cytoplasmic Ca^{2+} concentrations ($[Ca^{2+}]$) during egg activation are a highly conserved event that have persisted through the course of evolution. For example, fertilization in the starfish *Asterina miniata* results in two Ca^{2+}-dependent processes in the fertilized egg: a cortical Ca^{2+} flash, in response to the fast polyspermy block, followed by a global Ca^{2+} wave associated with the slow polyspermy block (Stricker. 1999. *Dev Biol* 211: 157-176).

The transparency of large *A. miniata* eggs (180 µm diameter) allows for easy monitoring of egg activation by confocal imaging. Here, *A. miniata* eggs were pre-loaded with cytoplasmic Ca^{2+} green-1 dextran and inseminated at first meiotic metaphase. The resulting Ca^{2+}-dependent fluorescence was recorded over time (1 frame per second). Selected frames, chosen to highlight specific events, were pseudo-colored to visualize changes in the $[Ca^{2+}]$, whereby low $[Ca^{2+}]$ is in blue and high $[Ca^{2+}]$ is in red. Dark circles in the cytoplasm of each egg identify the oil droplet used for dye injection.

Fluorescence in the initial frame (t=0 sec) shows Ca^{2+} green-1 dextran accumulation near the site where the germinal vesicle breakdown occurred. Seconds after fertilization, the cortical flash is observed as a halo of increased $[Ca^{2+}]$ surrounding the egg cortex (left series, t=3 sec); this phenomenon is difficult to capture because it persists for less than a second. Increased cytosolic Ca^{2+} briefly subsides (left series, t=6 sec) between the initial cortical flash and the global Ca^{2+} waves that radiate from the point of sperm fusion (both series, from t=15 sec onwards). On average, eggs maintain elevated $[Ca^{2+}]$ for 10-30 minutes (Stricker, 1999).

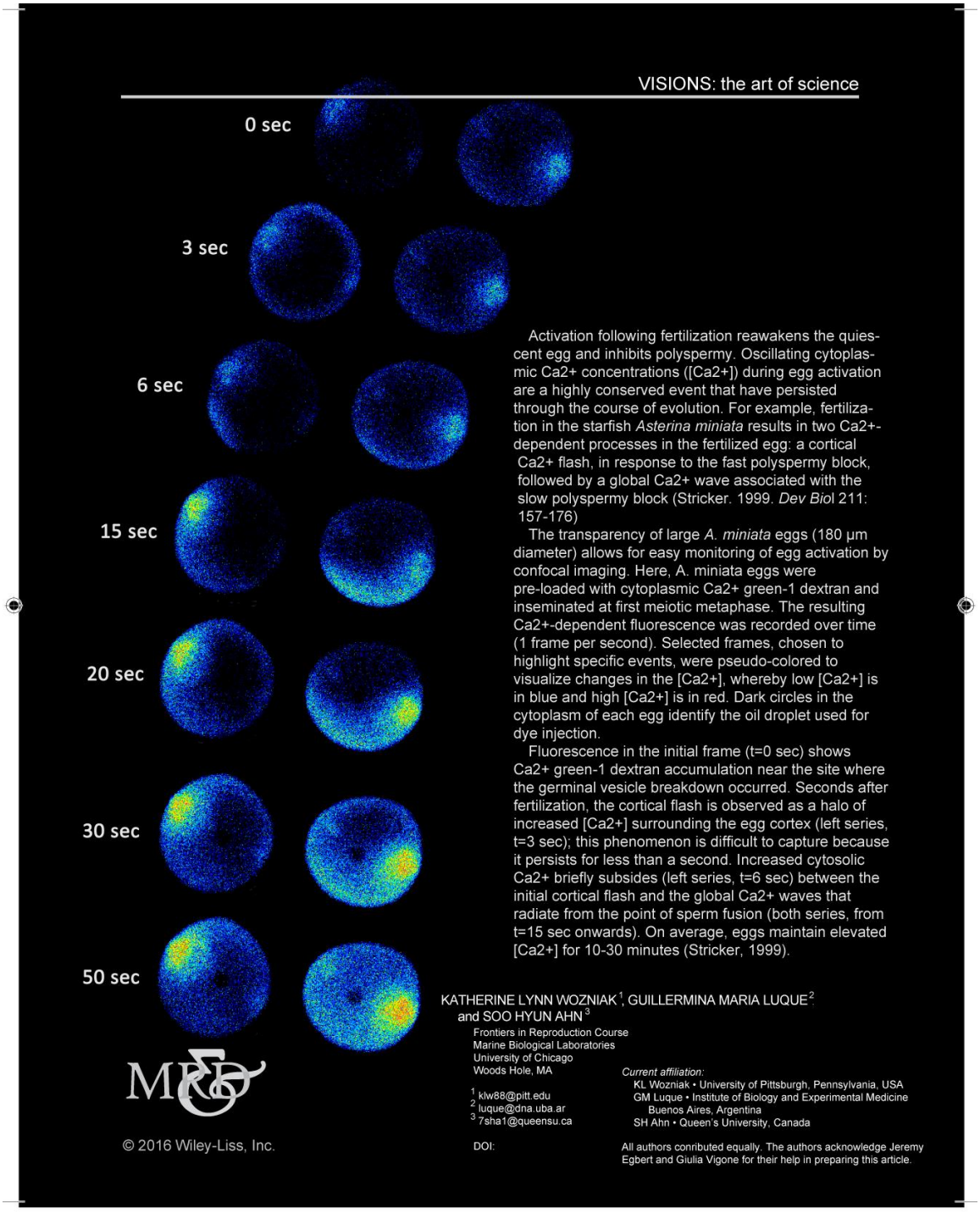

Figure 1