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The discovery of calcium waves

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The discovery of calcium waves was preceded by the discovery of a free calcium explosion in activating medaka fish eggs by Ellis Ridgway, John Gilkey and myself in 1977 [1]. We were motivated by reading Toki-o Yamamoto's remarkable reports of a calcium-dependent wave thru these millimeter sized eggs during world war II [2,3]. (Yamamoto was able to work during this war since he was too short for the Japanese army.) We used aequorin to see this explosion because of Ellis Ridgway's experience with it. I remember that he drove west to Purdue from Virginia, in a battered, old car without stopping to sleep. I also remember seeing him pace through Purdue biology's underground hallways as he chain smoked between experiments. Yes, he was intense.

The obvious next step was to image the activation process and the only place to do this was physicist George Reynold's lab at Princeton. So my grad student, John Gilkey and I flew to Princton with some fish. I vividly remember John and I holding large, round, swollen, fish-bearing plastic bags on our laps as we sat in the air plane en route to Princeton.

John Gilkey, Ellis Ridgway, George Reynolds, an undergrad named Andy Eisen and I then spent five exciting days in George Reynolds lab observing the calcium wave through activating medaka eggs. When we first saw the wave, I remember Andy Eisen crying out, 'Ooh, look at that!'. Then at the end of the week, we all got together in a dark room together with our very last aequorin-loaded medaka egg. We dark adapted for a half hour and then someone, somehow added sperm to the egg. Voila! It soon lit up so that we could all see it glow and continued to visibly glow for several minutes [4].

I remember George Reynolds (who died in 2005) as a cheerfully competitive man who was an amateur prize fighter.

Calcium waves thru activating eggs are now included in a class called fast calcium waves which are propagated by cycles of chemically induced calcium release from the endoplasmic reticulum. or by calcium induced calcium entry thru the plasma membrane. While fertilization waves all move at about 5 to 10 μm/s at room temperature, waves that are propagated by calcium release from the e.r. move at 10 to 30 μm/s; while ones that are propagated by calcium entry thru the plasma membrane move at 100 to 1000 μm/s. The three other classes of calcium waves are slow ones which move at 0.1 to 1 μm/s and are mechanically propagated, ultrafast ones which move at 10 to 30 cm/s and are electrically propagated and ultraslow ones which move at 0.1 to 10 nm/s [5]. I have become especially interested in fast calcium waves since I recently have had two seizures and these terrible events are well known to be propagated by fast calcium waves through the brain.

Web resource: the first calcium waves recorded by Lionel Jaffe and his colleagues can be seen in the BioClip "Sparks of life" which can be downloaded at http://www.bioclips.com/research.php3?id_rubrique=2&var_nav_year=&id_article=54.

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