# Abstract

New life begins with the fusion of an egg with a sperm cell. However, sperm do not encounter an egg by chance. The succesful encounter of gametes is a special challenge in marine animal kingdom. Most marine animals release their gametes into sea. To increase the success rate of fertilisation, eggs release chemoattractants to guide the sperm. The directed motion of sperm towards the source of chemoattractants is called chemotaxis. The chemoattractant of the sea urchin *Arbacia punctulata* is a short peptide called resact. The receptor for resact is a membrane-bound guanylyl cylase (ApGC). After stimulation with resact, ApGC synthesises the second messenger cyclic guanosine monophosphate. I studied the regulation of ApGC activity by dephosphorylation. ApGC is highly phosphorylated at rest and undergoes rapid dephosphorylation after resact binding. The activity of ApGC declines during dephosphorylation; the enzyme inactivates. To study the ApGC in more detail, I tried to express ApGC heterologously. Unfortunately, the recombinant protein was not phosphorylated. Studying ApGC regulation in intact sperm, I was able to show that ApGC phosphorylation is essential for its activity. The dephosphorylated ApGC displays no catalytic activity. The time constant for the dephosphorylation reaction is ca. 280 ms. This matches well with the time constant of inactivation. Remarkably, far more ApGC molecules are dephosphorylated at low resact concentrations than are occupied by ligand. Thus non-occupied receptors are dephosphorylated, too, which could account for an adaptation mechanism. What is the nature of the phosphatase? The phosphatase activity in sperm does not require physiological responses caused by resact stimulation. Classical phosphatase inhibitors do not block dephosphorylation. Taken together with the rapid time course of dephosphorylation and the high ApGC density, there is good evidence that the GC itself displays phosphatase activity. Phosphatase activity could be a common feature of other membrane-bound GCs and could help to understand the regulation of this protein family.