



# The cement gland – dopamine regulation and mechanisms of secretion

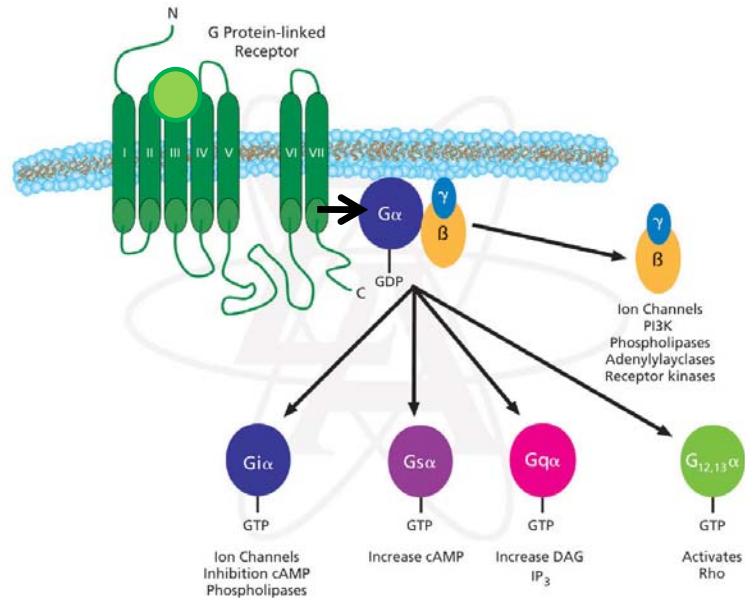
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Lindblad

Marine Paint, University of Gothenburg

# G-protein Coupled Receptors

● Agonist: Activates the receptor

Neurotransmitters, hormones, pheromones,  
photons and synthetic compounds.



Second messengers



Biological response

# Dopamine receptor classification

- Mammalian
  - D1-like (D1 and D5 receptors)
  - D2-like (D2, D3 and D4 receptors)
- Invertebrate
  - D1-like
  - D2-like
  - Third subgroup
    - Invertebrate Dopamine Receptor (INDR)
    - Octopamine/Tyramine like
    - Dopamine/Ecdysteroid receptor (DmDopEcR)

# The cyprid cement gland



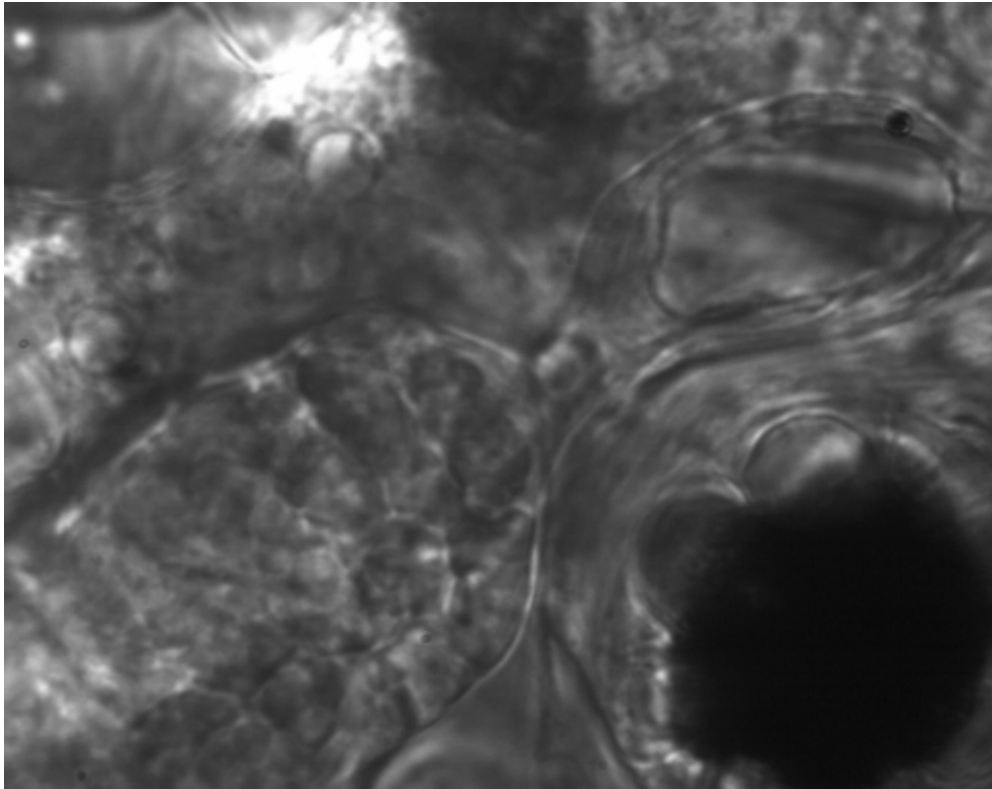
Walker 1971 – histology – granulae description  
Okano 1996 – in vitro – catecholamine activation  
Ödling 2006 – in vivo – mechanism of secretion

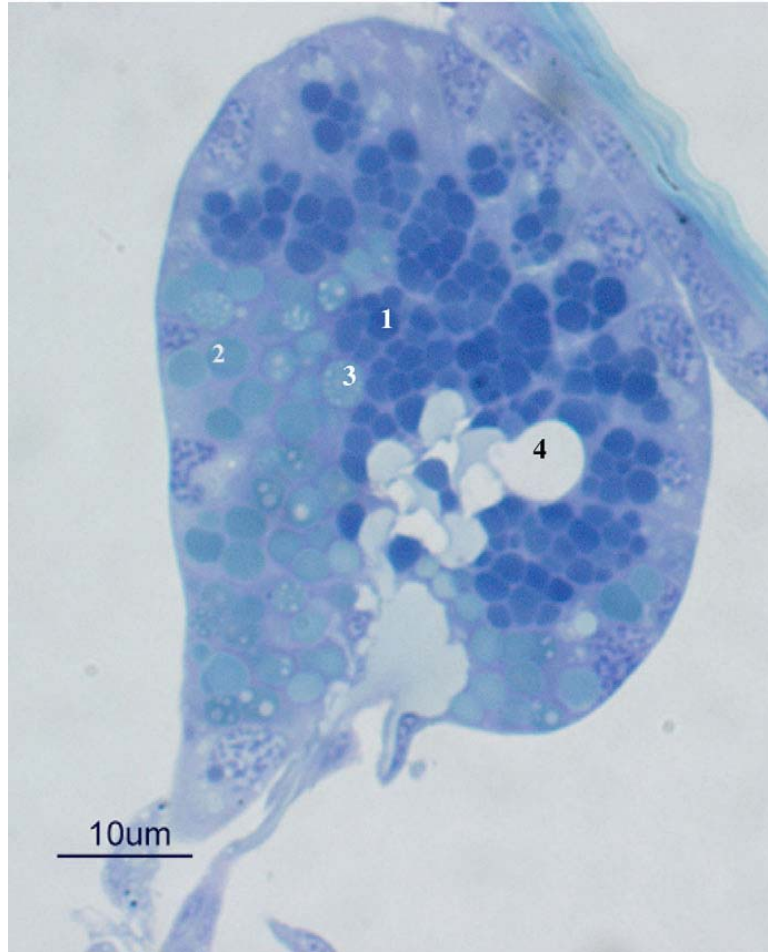
- Secretion is induced by dopamine
- No effect of histamine, serotonin, octopamine, tyramine, melatonin
- Dopamine receptors in invertebrates – classification differs from mammalian classification

# Cement secretion – in vivo

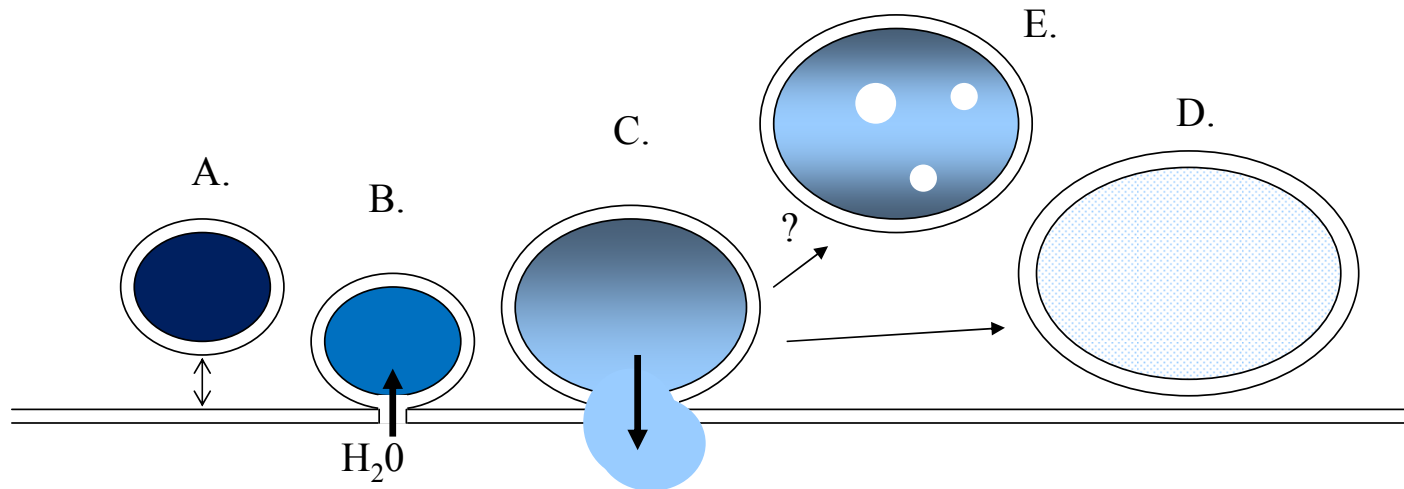


*a MISTRA funded research programme*



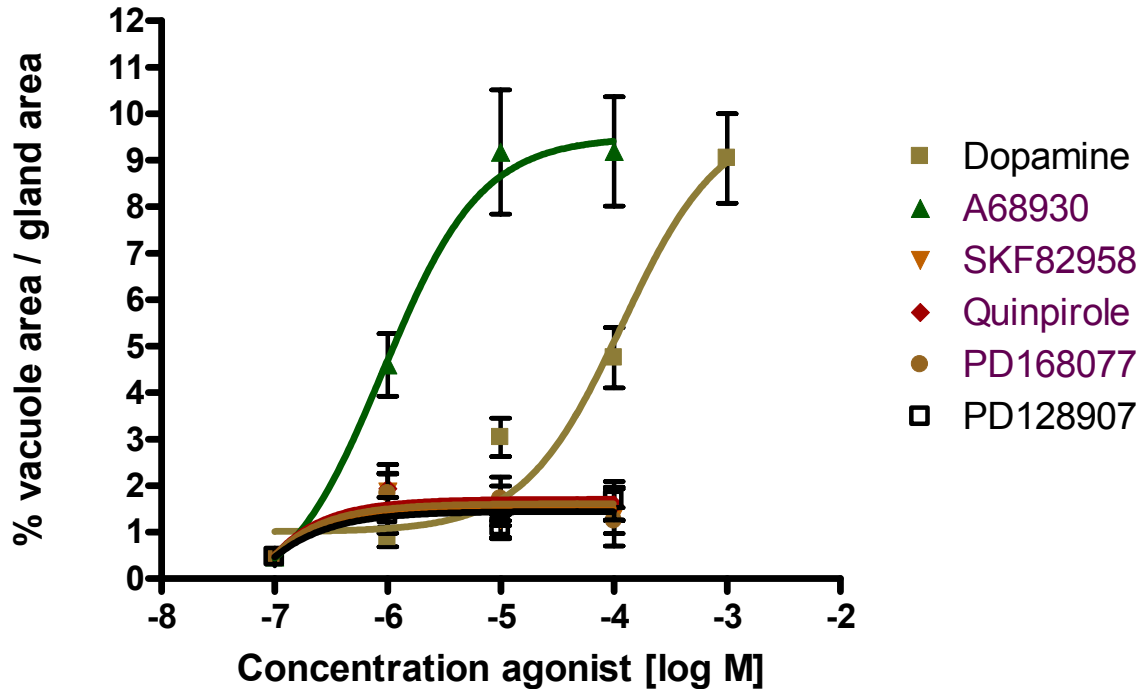


# Fusion of a granule to a planar bilayer



- A. Docking and formation of fusion pore.
- B. Vesicle swelling, expansion of fusion pore.
- C. Exocytosis, release of cement proteins.
- D. Degranulation sac -vakuole.
- E. Ragged loss?

# Dose response curves





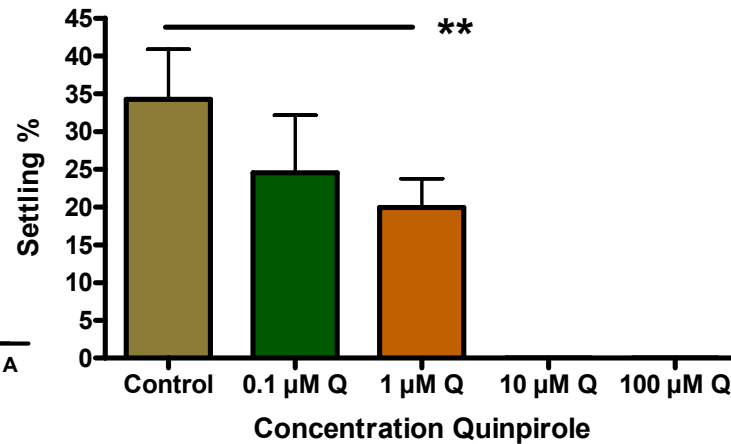
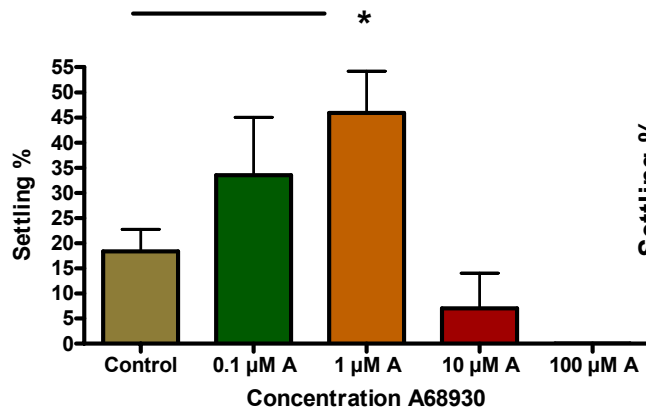
# Settlement



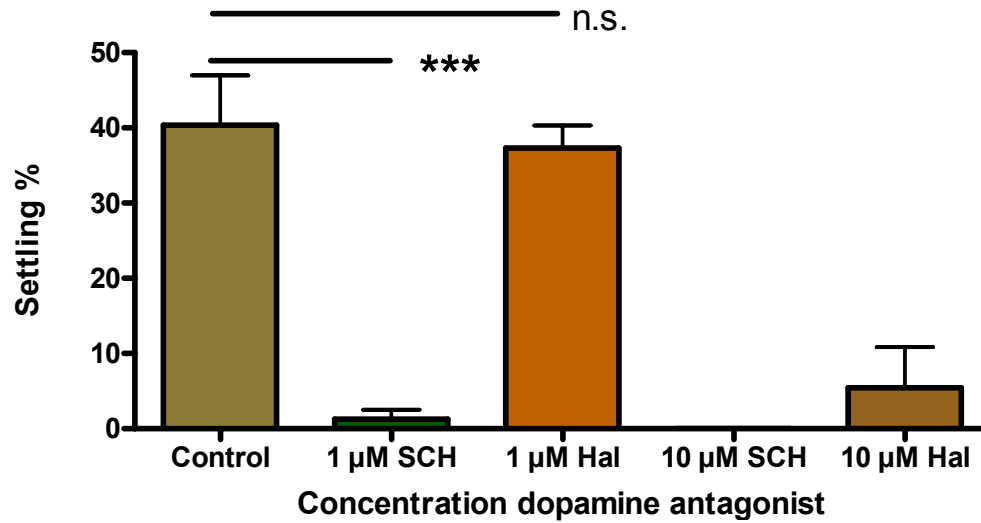
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- Several studies claim dopamine as an inducer.
- Could the secretion pharmacology be reflected in settlement ratio?
- The antagonists, will they inhibit settlement?

# Dopamine agonists



# Dopamine antagonists



# Conclusions



*a MISTRA funded research programme*

- Cement secretion is probably governed by a D1-type of dopamine receptor.
- We wait for gene sequences.
- By altering the cement secretion, it is possible to promote or inhibit barnacle settlement.



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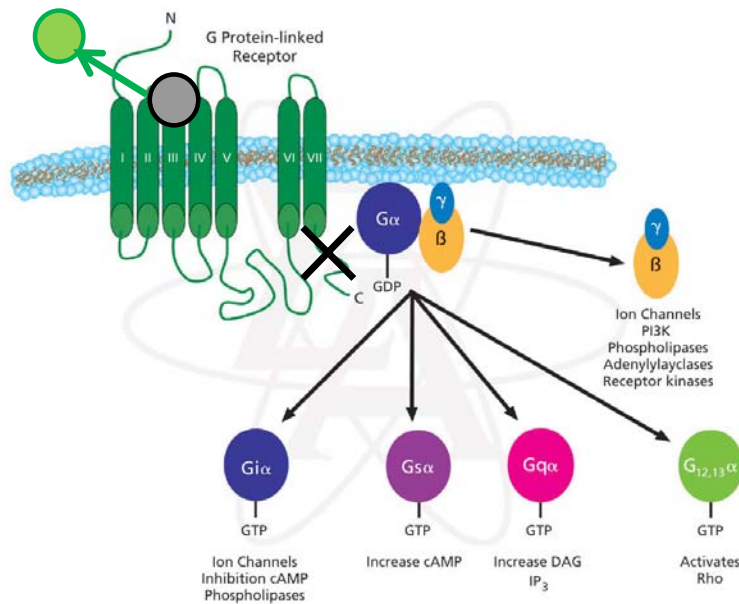
# Cement granules



- Proteins highly densely packed
- When stimulated – densely packed granules disappear
- When stimulated – vacuoles appear
- Quantifying cement secretion – measuring vacuole area in stimulated cells
- Possible to achieve dose-response curves
- Pharmacological evaluation

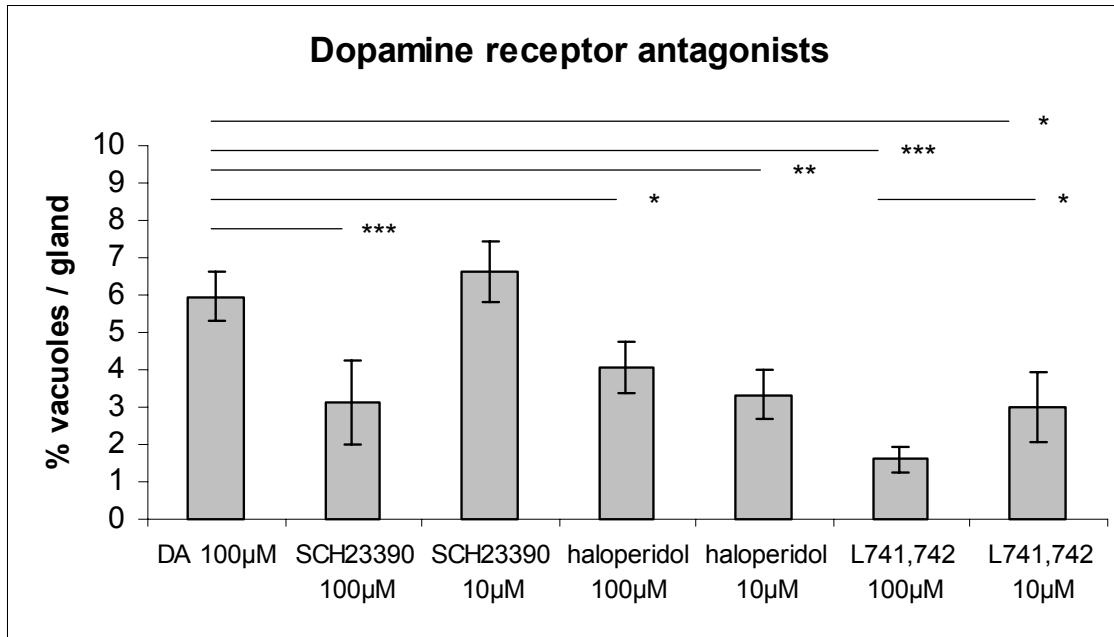
# G-protein Coupled Receptors

- Antagonists: Inactivate the receptor.  
Synthetic compounds



Inhibition of biological responses

# Antagonists





# Mechanisms of exocytosis

